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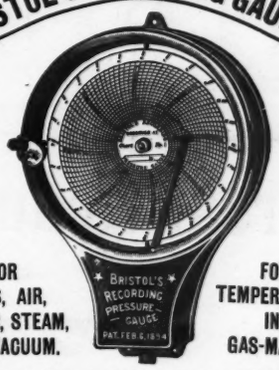

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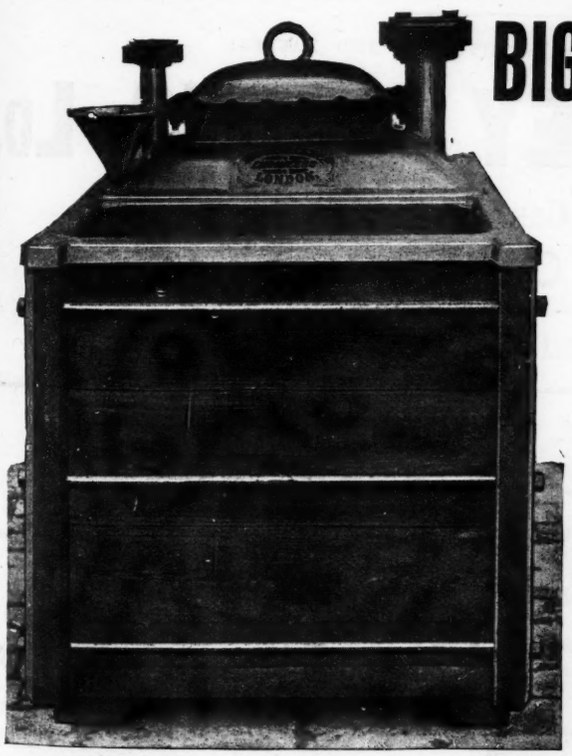

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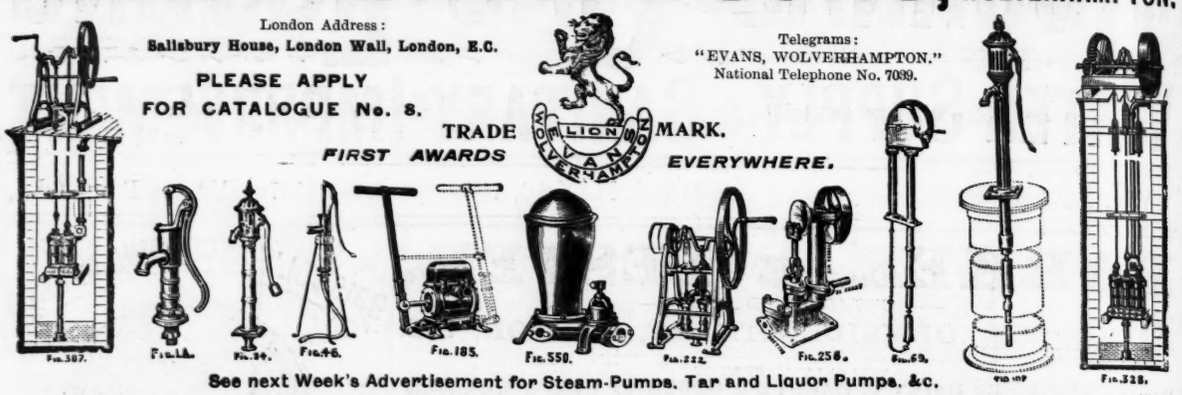

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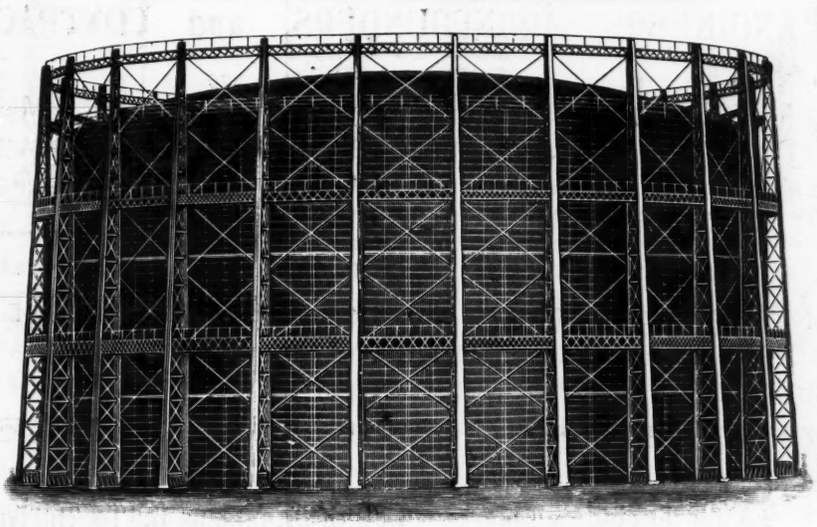

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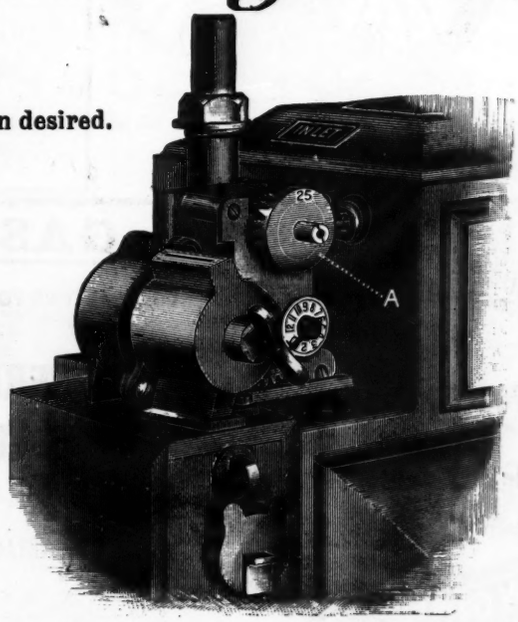

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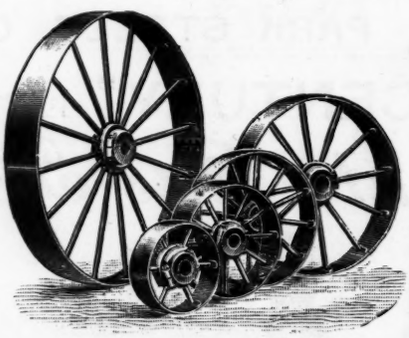

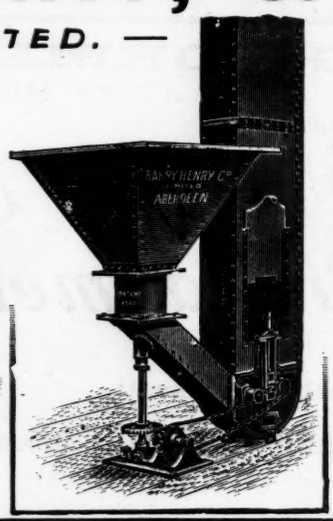

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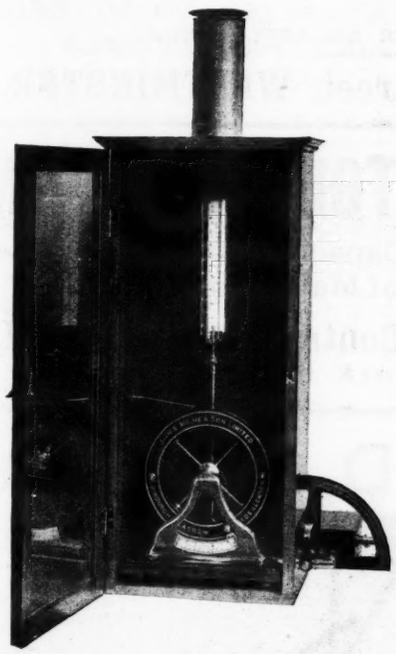

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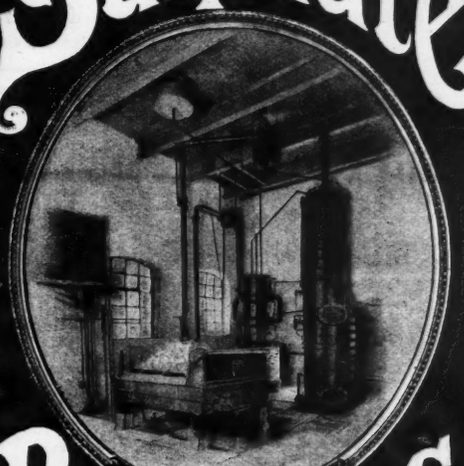

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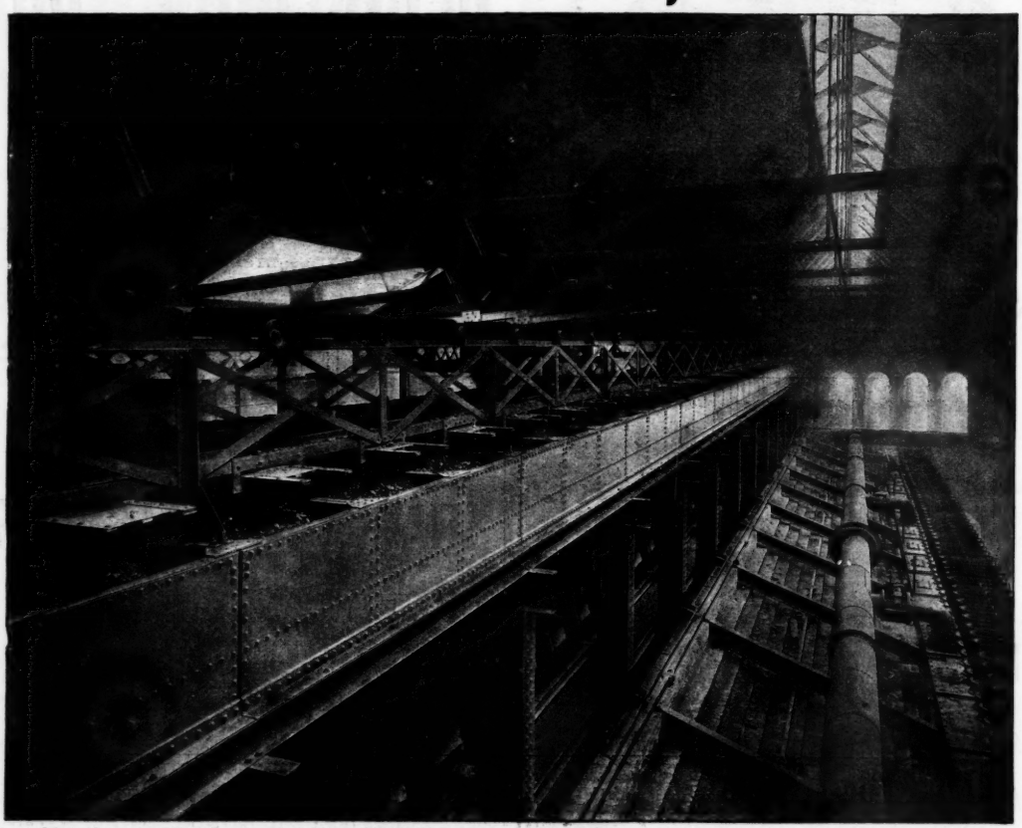

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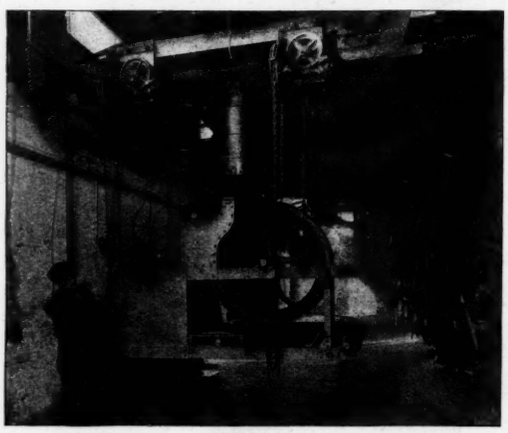

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VOL. XC., No. 2192.—TUESDAY, MAY 16, 1905.

EDITORIAL NOTES—GAS, &c.

The Inclined Retort Contract for Milan.

AFTER a most patient hearing on the part of Mr. Justice Grantham, the last act in the great case of *Graham, Morton, and Co. v. Compagnie L'Union des Gaz* was witnessed yesterday morning, and in the manner anticipated, though with a severity unexpected, but in many respects richly deserved, in regard to the language employed by his Lordship. The hearing has occupied some sixteen days, terminating with a speech of three hours' duration on Saturday from Mr. Hamilton, K.C., the leading Counsel for the defendants. Of the strength of the case he had to attack, it was apparent to all observers that he was deeply conscious. At the close of the speech, his Lordship stated that he should not require to hear Mr. Rufus Isaacs, K.C., in reply for the plaintiffs, for whom he gave judgment yesterday—marking, too, his sense of the character of the case by allowing costs on the higher scale. The judgment, which is reported *verbatim* elsewhere, triumphantly vindicates the character and high reputation of the plaintiffs, and is an emphatic condemnation of the course pursued by the defendant Company. Terms more scathing than those in which the learned Judge described the conduct and attitude of the principal actors in this painful drama have seldom been heard from the judicial bench. We are most sorry for those who, being shareholders in the Company, cannot but suffer from the mismanagement which now stands revealed in all its nakedness; but we do not conceal our satisfaction with a result which is so splendid a testimonial to the high character of British work and workmanship. We are greatly mistaken if our congratulations to Messrs. Graham, Morton, and Co. are not shared by the vast majority of our readers.

The circumstances of the case may here be briefly stated. During the years 1900 and 1901, defendants had experienced great trouble owing to labour difficulties in Milan, and were anxious for an installation of retorts with labour-saving appliances. They accordingly entered into contracts with Messrs. Graham, Morton, and Co., the senior member of which firm has been identified with the development of the inclined retort system almost from the commencement. These contracts were for two complete installations of inclined retorts, each consisting of two benches, and each bench containing eight beds of nine retorts. As the defendants were inadequately provided with gas-making plant, the time to be occupied in the construction was an important consideration; and the plaintiffs undertook to complete the contracts in what may be regarded as a record time for work of this nature and extent. The contracts were settled in January, 1902, and the work was completed the following September, in spite of all difficulties consequent upon the distance to which materials had to be transported, and the hostility of the workmen to the introduction of anything that might tend to lessen the need for their employment. So pronounced was this, that it was found necessary for the foremen and others to carry revolvers for their protection. It was stipulated that after a sufficient time had been allowed for drying the beds, a month's test should be made, in order to ascertain if the guarantee as to efficiency had been fulfilled; the contract specifying that each retort should be capable of carbonizing 300 kilos. of dry coal every six hours, with a consumption of fuel not exceeding 15 per cent. This test seems to have been only partly carried out; the defendants being hard-pressed for a supply of gas at the time, and having in consequence to charge these retorts at more frequent intervals than six hours. This naturally had its effect upon the heats, the work being so new. But notwithstanding this, the results of the test appear to have been satisfactory.

Mr. Corbet Woodall, however, who was at Milan at the time, and reported to the defendants that the heats were poor, although the work appeared to be excellent, recommended that the testing should be discontinued, and resumed in the spring. The tests were accordingly discontinued, but instead of agreeing to their being resumed in the spring, the plaintiffs arranged to leave in the hands of the defendants the sum of £1000 on account of each contract, until the following March, when it was to be paid them, provided the defendants were then satisfied with the work. When March arrived, the money was paid by the defendants. There was, however, a further guarantee under the contracts as to the durability of the retorts, which were insured for two years by the sum of £2000 retained on account of each contract. It was for the recovery of this retention-money that the action was brought; the defence set up being that the plaintiffs' work did not comply with the terms of the contract, inasmuch as it was not free from inherent defects, being bad in design and execution, in consequence of which the defendants had been put to an expense of many thousands of pounds in the substitution of other settings. No indication of dissatisfaction, however, seems to have reached the plaintiffs for a considerable time after they had left the work; and it was only in December, 1903, according to Mr. Graham, that they first became aware that the Company's Engineer-in-Charge, Mr. Bourne, had altered the construction of the generators. Apparently, Mr. Bourne was at that time dissatisfied, for some reason or other, with the system; and in the following January or February, the defendants were in negotiation with M. Derval, a French retort-setter, for improving the Graham-Morton settings. "Improving" seems in this case to have meant complete demolition and substitution of a French type of retort-setting; this being what speedily happened as regards the first bench.

In the meantime, a French Engineer, M. Freyss, appeared on the scene, and he was not long in announcing a deficiency in the stock of coal of about 16,000 tons, though whether he was the first to make this discovery is not quite clear. Whatever be the qualifications of this gentleman, he seems to have been lacking in practical experience; almost his first act being to open wide the dampers of the settings—a proceeding which drew from Mr. Bourne a strong remonstrance. Had he desired to burn down the settings, he could hardly have done anything more likely to be effectual. Mr. Bourne was, however, soon afterwards superseded; and the demolition of the Graham-Morton retort-settings went merrily on. Becoming now fully aware of the position, the plaintiffs called in the aid of experts. Accompanied by Mr. W. R. Herring, of Edinburgh, and Mr. Hulse, who has had for some years the management of similar settings at Leeds, they visited the scene of demolition in April, 1904; and in the following month a second visit was paid—the party consisting, in addition to Mr. Graham and Mr. Leech (plaintiffs' engineer), of Messrs. Charles Hunt, Herring, and Shoubridge. All these gentlemen gave evidence at the trial, in addition to Professor Lewes, who also visited Milan. Their testimony was signally reinforced by that of Mr. Naylor, until recently Superintendent of the Rochdale Road Works of Manchester, and now Gas Engineer to the Rotherham Corporation. Happening to be travelling in Italy, he visited the gas-works at Milan, and was astonished at the work of destruction going on; this being—according to his judgment and experience—quite unnecessary.

On the other side, the brunt of the defence was borne, not by Mr. Green, the Company's Engineer, who had seen the drawings at Edinburgh, and was a party to the contracts, nor by Mr. Bourne, who had worked the settings for more than twelve months; but by M. Freyss and Mr. F. D. Marshall, who became the Company's Consulting Engineer only in May last year. This goes far to confirm the correctness of Mr. Justice Grantham's diagnosis at the commencement of the case, that it seemed to be a battle between English and French. The learned Judge commented very severely upon the evidence given by these gentlemen, in

view of which perhaps the least said the better; but the comments of the Judge stand recorded in other columns. For the plaintiffs, it was contended that the design was good, as was proved by the fact of similar settings giving satisfaction at Edinburgh and Leeds; that the material and workmanship were the best of their respective kinds; and that whatever inconvenience had been experienced was due to mismanagement of the settings by the Company's employees. As regards the latter, reliance was placed, not so much on the dissatisfaction of the Directors themselves, as evidenced by the changes made by them in the management, as upon the proofs afforded by the condition of the beds when pulled out—these showing excessive deposits of carbon in the retorts and accumulations of clinker in the generators; besides evidence of direct firing, resulting, as was alleged, from excessive draught and the fuel in the generators being allowed to burn too low. It was also pointed out that the alterations made by Mr. Bourne had greatly reduced the effective grate area of the generator. On behalf of the defendants, numerous objections, more or less trivial, were urged against the material and workmanship; and the design was attacked mainly with regard to the capacity and shape of the generator, the depth of fuel bed, the dimensions and shape of the gas passages and nostrils; the distribution of heat in the setting; and the construction of the regenerator. It was also contended that the alteration made by Mr. Bourne in the generator was an improvement on the original design; and the injurious effects of the excessive draught which, as alleged by plaintiffs, caused direct combustion, and thereby destroyed the brickwork, were disputed.

It is evident that some of this criticism was directed to matters as to which experts may reasonably differ; but there are others which form a real test of experience. How, for example, could anyone practically acquainted with the action of a regenerative furnace seriously deny the evil effects of excessive draught? and was there no one in the service of the Company, after Mr. Bourne had left it, to point these out? Then as to the depth of the fuel bed, we are quite at a loss to understand how anyone, with a reasonable amount of experience of such matters, can contend that a depth of 2 feet, or even of 1 ft. 6 in., is not sufficient, so long as the air supply is regulated accordingly. Carbonic oxide results from incomplete combustion; and its production is as readily promoted by a thin as by a thick layer of fuel. In regard to the generator also, it is difficult to understand how the Bourne alteration could have been an improvement, if it reduced the effective grate area by 20 per cent., as alleged for the plaintiffs.

Assuming, however, the justice of the defendants' criticisms, it does not appear from the evidence that any genuine attempt was made to remedy what was regarded as faulty in the design, if the alteration of the generator be excepted. And if such an alteration could be effected, why not others? A great deal was made of the shape of the gas nostrils, and of their inaccessibility for clearing out; but nothing was done in the way of alteration, although Mr. Bourne estimated that this could be carried out at a cost of only £20 per bed. Such alterations are commonly enough made; and that nothing of the kind was done seems like a corroboration of Professor Lewes's expressed opinion "that there was "no management at all."

In the opinion of the learned Judge, however, the defendants completely failed to prove their case; and, indeed, no other conclusion is possible from a perusal of the evidence. The way in which it was sought by the defendants to discredit the officers of the Company who superintended the installation and worked it with apparent success for more than twelve months, was severely commented upon by his Lordship, who in this connection showed his utter disbelief in the statements of the Chairman of the Board, Mr. Arthur Lucas. It was incredible, in the eyes of his Lordship, that contracts of the value of £70,000 or £80,000, to be executed many hundred miles away, could have been entrusted for execution without the slightest supervision being exercised over them. If this was true, then there was negligence on the part of the Board that shows them to be totally unfit for the trust reposed in them by the shareholders. The whole case is a revelation of the helplessness and ineptitude of the Directors. One year they build these settings wholesale, so to speak, and at enormous cost; the next year they pull them all out, and begin again. Surely there never was such child's play on the part of presumably business men. They placed entire confidence in Messrs. Graham, Morton, and Co., "consider-"ing," as the Chairman stated in his evidence, "the position "the firm occupied as contractors for this kind of setting." They withdrew that confidence twelve months or so afterwards, without, so far as has been made public, giving the firm the slightest opportunity of vindicating their reputation. But his Lordship did his utmost to remedy the injury done the firm. Never was a tribute from the mouth of a Judge more merited than that paid to them. He appreciated, deliberately and to the full, the energy shown by the plaintiffs, and their readiness, as proved by the evidence, to interpret their obligations with liberality, and to meet the wishes of the defendants in every possible way. Reputations have, indeed, been at stake in this affair; and the losers pay the forfeit. That, however, is but little compensation for the loss of prestige which English control of foreign undertakings must endure from such a palpable example of mismanagement.

Manchester District Institution Meeting.

It was with more than ordinary pleasure that the President of the Manchester Institution of Gas Engineers (Mr. S. Meunier) and a large body of the members visited Leeds on Saturday. Those controlling the gas interests in the city —the premier gas interests in respect of the volume of business in Yorkshire—have not hitherto taken any very active part in the work of the district organization. The aloofness has been strange, in view of the pronounced geniality which has invariably been found when opportunity has permitted personal contact with the rulers of the Corporation Gas Department and their chief officer. We cannot think of anything more ungenerous to say about it than that it merely seems to have been an antiquated custom which has been religiously conserved up to the present. But the conservatism of the past is not the policy of the future. Saturday's reception and proceedings marked the "parting of the way" of Leeds, and welded, we hope perpetually, the link between the heads of the gas interests of Leeds and those of the body representing the gas industry of the greatest industrial area in the country. The Chairman of the Gas Committee (Mr. Councillor Ratcliffe) and those who are united with him in conducting an important municipal service associated themselves, in the most affable manner, with their General Manager (Mr. R. H. Townsley) in contributing to the enjoyment and technical attractions of the day. The New Wortley gas-works were thrown open to inspection; and the old and new plant there—comprising horizontal retorts with stoking machinery of two well-known types, and inclined retort-settings only lately constructed—animated a critical investigation into comparative merits, which should greatly assist individual judgment in future. The plant for making bricks and slabs from spent lime and clinker was also eagerly inquired into.

The Council Chamber at the Town Hall was placed at the disposal of the members for their business meeting; and of the matters brought under consideration, that introduced by Mr. John C. Belton, in virtue of its freshness, deserves foremost place. The subject was the Jäger system of fitting purifier-boxes. It has frequently been said that, with all the research that has been made, our knowledge of the actions that take place within the four corners of the purifier-box has not been perfected; and the gas manager who suddenly finds himself involved in some mysterious perverse conduct on the part of his purifiers, which perhaps perturbs him for hours before the corrective is found, requires nothing more than that to convince him of the truth of the well-worn assertion. But that is not the point of Mr. Belton's paper, though it has some relation, in that he proves pretty conclusively that, while the purifier-box and its connections have undergone considerable improvement, the interior of the box—the methods of accommodating and distributing the purifying material—with the view of getting the utmost work out of it with the minimum of resistance, has been the subject of little concern. He does not say so pointedly, but that is the deduction which he leaves to those who heard, and those who read, of his experience with the system with which he has equipped two out of a set of four purifiers at Chester. It is indeed a singular thing—though the singularity has not been so striking until the unlooked-for benefits of a new plan is brought to notice—that generations of gas engineers have not, till recently, discovered anything better than the old form of grid upon which to accommodate

the purifying agents with which they have charged their boxes. The figures which Mr. Belton's paper presents, together with those which appeared in the article that he contributed to the "JOURNAL" in February last (to which sources we must refer readers for the records), are testimony to the existence of a substantial, though of course varying, proportion of unutilized space in purifiers with the old-fashioned grid system in use, and therefore to the existence, by the continuance of the system, of an uneconomical utilization of any given purifying area. If, by the new system, any given area can be made to do a greater amount of work, and—this is also of importance—with a reduction of back-pressure to a degree unattainable under former conditions (and Mr. Belton's experience and that of several other engineers attest that it is so), then we have facts and possibilities here that cannot be neglected by the engineer when considering the improvement or extension of his purifying plant. It means that, before spending capital on the erection of new boxes, the engineer must, with any such method before him as is described in the paper, consider whether a larger amount of work, and more effective work, cannot be obtained by the simple process of changing the internal arrangements of his existing boxes, and, on the time eventually arriving when additional boxes are imperatively necessary, whether it will not be wise, simultaneously with their construction, to enhance by the same means their effective capacity and also prolong their duration in meeting requirements. The increase of the operative capacity without adding to the dimensions of the boxes, and the reduction of the back-pressure, are only two of the advantages credited by experience to the system. The slow horizontal travel of the gas which other engineers besides Mr. Belton agree gives a relatively long time-contact with the material, the complete and uniform exhaustion of the material, and the reduction of labour through the extension of the period within which the vessels require changing, all point to the superiority of the new over the old, although some of the critics at the meeting were not prepared—doing well themselves under the old system—to concede any marked superiority. Mr. Belton (who was one of the first in this country to recognize the merits of the Jäger system) has done the profession a service in giving its members the benefit of his experience as it has progressed; and it is a satisfaction to find that the experience of the present is confirmatory of that of the past. On the whole, the reception of the system was cordial in the discussion, but not enthusiastic. The enthusiasm will probably come with extended experience.

The general business discussed by the members included a proposed alteration of the rules providing for the admission to the Institution, as associate members, of "commercial superintendents or general managers of gas undertakings solely employed as such, and assistant engineers or assistant managers of gas-works making 500 millions or more per annum." But the question was deferred for further consideration at the next ordinary meeting. The difficulty which the members find is one of discrimination as to who should or who should not be eligible for election to this class. Our own sympathies find expression very much in the speech of Mr. J. W. Morrison. The general managers of gas undertakings ought decidedly to have a place in the membership of such an Institution; but we cannot understand exactly what manner of man in connection with a gas undertaking is contemplated by the "commercial superintendent," as we take it that every general manager, or, where there is not an official so designated, the engineer, is responsible for the supervision of all matters relating to the commercial part of the business of a gas undertaking. The question of the admission of assistant engineers or assistant managers is another matter; and it does seem, and is, a ridiculous thing that fully trained men subordinate to the chief of important works should be disqualified from membership, while men are not who are managing works whose output in a year is perhaps only as much as the other man is responsible for in a day or a week. There ought surely to be a means of overcoming the difficulty. There cannot, of course, in a district organization be an examination into the proficiency of assistant engineers who may be candidates for membership; but the junior associations would be protected, justice done to assistants, and the interests of the Institution preserved, if associate membership was made conditional on a time-limit of service as an assistant, combined with discretionary power to the Committee of the Institution in declining or otherwise to accept names for presentation to the members. Under such circumstances, the second clause of Rule 1 (if a suggestion is permissible from outside) might read: "Associate Members.—General managers of gas undertakings solely employed as such, chief assistant engineers or managers who have served in such capacities for not less than five years —it being within the discretion of the Committee to accept or otherwise their nomination for presentation to the members for election." Among other matters, it will be observed that the Institution are going to adopt the Question-Box system, and propose co-operation, by exchanging questions, with the Revision Board of the Ohio Gaslight Association.

The Private Consumer and Public Lighting.

WE confess to incapacity in understanding the reasoning of men who claim that the cost of electricity for public lighting should be that of production and no more, on the ground that in the case of a municipal undertaking the producer and the consumer are one. Apply the principle to municipal trading generally, and municipal trading as a thing to be desired by local authorities would soon find a new level. Carry it to its logical conclusion, and the private consumer of electricity, being also of the producers, and giving his custom to the electricity undertaking (which the non-electricity-consuming ratepayer does not), ought verily to have equal consideration with the public lighting, which is only a partial customer in most cases. The contention as to public lighting being favoured in the manner proposed appears—though it is not by any means new—in a letter in a municipal organ, in which the writer discusses what appears to him to be the "dishonesty" of the Stepney Borough Council in taking from the ratepayers for public electric lighting no less a sum than £7895. In relation to the total earnings of the electricity undertaking—£32,125—the charge for public lighting is about one-quarter. He seems to regard the cost of production with which the public lighting should be charged as 0·85d. per unit; but this only includes the cost of fuel, oil, waste, wages, and repairs. Salaries and establishment charges entail an expense of 0·25d. per unit, and interest and sinking fund one of 0·63d. Here we have a total cost of 1·73d. per unit; and as the public lighting charge works out at 1·55d. per unit, someone has to make up a loss of 0·18d. per unit on close upon 1 million units consumed by the public lamps. Where is the justice of this (let alone the absurd proposal to charge only 0·85d per unit) to those consumers who supply about three-quarters of the revenue of the department? Of course, the degree of use has a bearing upon the matter; and if the public lighting by electricity happens to be only a trifling affair, one might look with a little leniency upon the suggestion, but not otherwise, though even then there would be the danger, if such a thing were countenanced in a small way, of an eventual undue advantage being taken of the privilege. The owners of gas undertakings look upon this question in two lights—as competitors, and as contributors to a very material extent to the public funds. As ratepayers, who have to pay part of the cost of the public lighting, the lower the charge for electricity, the better, and the less the support given to the competing business. On the other hand, to supply electricity to the public lamps, or to anyone else, at less than the price that will cover the average outgoings per unit, is unfair competition. Where differential prices do obtain, transactions at the low figures can only be genuine by the profit alone being narrowed down to such points as are necessary to capture and retain business according to its character in regard to bulk; and public lighting by electricity should be treated on these lines, and not be befriended in any other way. We are not discussing the matter of electricity being an uneconomical method of performing this public service; that being only another aspect of the question we have to frequently deal with, and is daily receiving affirmative proof.

Considering the subject in hand from the point of view of the consumers of electricity, the proposition that the current used for public lighting should be charged only the cost of production and no more, is distinctly unfair to them. They are both ratepayers and consumers; and if all costs other than those of mere production are to be borne by them and not spread over the whole of the output of electricity (including that used for public purposes), it is a serious business—for them. Quite properly, they might ask why they

a small section of the ratepayers, should pay, through the charges made upon them for current, any portion of expense which should be a charge upon the whole body of ratepayers. It is on such grounds as these that we have protested in times past against the ill-founded policy practised by a few municipalities, of obtaining free gas supply and lighting for the streets from their Gas Departments. Nothing could be more monstrously unfair to gas consumers, more especially now that they, in most large cities and towns, are consuming an article whose freedom in the matter of attaining greater cheapness has been seriously curtailed by a competitor to which the greatest indulgence is being everywhere displayed. The unfairness to the private electricity consumer of the proposition to supply the public lamps at the cost of production, bad as it is, is not the equal of this unsound administrative practice of certain municipalities. Regarded only from a selfish standpoint, any injustice of this kind upon the private electricity consumer is not (always provided the electricity undertaking pays its way) a matter over which gas suppliers need really concern themselves, seeing that anything which tends to keep up the price of electricity must redound to their advantage in the competition for private business, combined with which, as said, it lightens the gas suppliers' contribution to the rate for the lighting of the streets—that is to say, in those cases where the public lamps are supplied with electricity at a low price, and the profits from the private consumers are sufficient to bring about that desirable correspondence of income and expenditure, which unfortunately is not frequently a condition upon which electrical concerns can pride themselves. In such cases as the latter, not only do gas undertakings have to assist in making good the deficit on the electricity undertaking, but they suffer from the competition of a business conducted on an uncommercial basis.

On the whole, however the matter is inspected, the conclusion must be drawn that the fair thing to all—electricity consumer, gas supplier, and ratepayer—is to make the public lighting responsible for its proportionate share of all outgoings connected with the production and distribution of electricity, as well as the whole costs attaching to the erection and maintenance of, and labour involved by, the lamps themselves. Whatever advantages might accrue to gas suppliers from the public lamps being charged with only the bare producing cost of the electricity consumed, such a system of doing business has for them (including the loss of a portion of the street lighting) its disadvantages; and it must involve injustice to the private electricity consumers.

Acceptance by the Board of Trade of the Northumberland Clause.

THERE is before us ample reason for believing that the Board of Trade are now in a relenting mood. Austerely they have opposed in the past, both inside and outside the Houses of Parliament and the Committee Rooms, any recognition of clauses—such as the Bermondsey or Northumberland—having for their object the prevention of deficiencies on municipal electricity supply and the protection of the ratepayers. Soon after the South Metropolitan Gas Company (sustaining their well-established rôle of pioneers in gas reform, progress, and defence) secured the insertion of the original form of clause in the Bermondsey and Woolwich Electric Lighting Orders, the Board evinced such a dislike to it, and directly refused its insertion in Orders while being dealt with by them, that gas companies, as large ratepayers, had no option—in view of what was very generally happening through municipal trading in this direction—but to appear in opposition to Electric Lighting Provisional Orders Confirmation Bills as they were introduced into Parliament, for the purpose of securing, if possible, protection for themselves, and (as a consequence) also for the great majority of other ratepayers who are not electricity consumers. Then again, on this move being made, the Board of Trade went almost everywhere—to the Court of Referees, to the Lord Chairman of Committees, to the Chairman of the Unopposed Bills Committee of the House of Commons, and both to the House of Lords and House of Commons—making what looked much like a frenzied attempt to frustrate the appearance of the original clause in any Order, even if inserted by agreement with the promoters, or by sanction of a Select Committee. Gas companies persevered. Then came the great inquiry into a number of opposed Orders by the Duke of Northumberland's Committee, and the passing by them of a set of provisions which, while modifying the Bermondsey clause, and giving electrical undertakers a period of grace (long enough for them to set their houses in order and establish themselves in business if good fortune attended them), also conferred the needed protection upon the ratepayers, and, in fact, extended it in certain ways—by, for instance, limiting the maximum price to be charged for street lighting to a rate not higher than that charged to consumers using energy for similar purposes and for the like hours of supply. Even since then, the Board have been reluctant to allow the clause. But it is obvious that they can no longer make any reasonable objection; and what has taken place during the past few weeks appears to afford sufficient ground for saying that, where pressed for in the case of Electric Lighting Orders, the Board will grant the Northumberland clause rather than put the promoters to the expense and trouble of fighting over the matter in Parliament. That—if what has already been done may be taken as the policy of the Board for the future—is a very commonsense course.

One of the Electric Lighting Provisional Orders in which the Northumberland clause appears this session, and which, with it in, was presented (as Electric Lighting Order Confirmation Bill No. 3) to the House of Commons by Mr. Bonar Law on behalf of the Board of Trade, is that promoted by the Woolwich Borough Council. Now the Woolwich Electric Lighting Order of 1902, it is within recollection, was second to Bermondsey in having the original clause incorporated. On the promotion of the Order of this session, so our information goes, the Borough Council agreed, at the instance of the South Metropolitan Gas Company, to the insertion of the Northumberland clause. The Board of Trade, according to custom, struck out the clause; but, as the South Metropolitan Gas Company were determined to fight the matter to the end, the Borough Council, it is understood, approached the Board asking them to save them that result of their act, by restoring the clause. It does seem absurd that the Board should ever, after parties had agreed to the inclusion of the clause in an Order, have taken such an extreme step as to estop its ultimate enactment; seeing that in such cases the Board's action has meant the infliction of additional expense on both promoters and those with whom they had bargained for the embodiment of the clause. However, in the Woolwich case, the Board, on the representations of the Council, restored the clause; and there it is now.

The Woolwich Order Confirmation Bill, however, does not stand alone in supplying evidence of the Board having retired from their former position of insistence on municipal trading in electricity having absolute liberty—to the financial hurt in numerous cases of the ratepayers. For this valuable supplementary information, we are indebted to the assistance of Mr. C. F. T. Blyth (of the firm of Messrs. Blyth, Dutton, Hartley, and Blyth). In No. 1 Electric Lighting Orders Confirmation Bill, we learn that, of the group included in it, the Northumberland clause appears in the Bury (rural), Golborne, Little Lever, and Southall-Norwood Orders. In No. 5 Confirmation Bill, the clause is found in the Hessle, Little Hulton, and Ravensthorpe Orders; and in No. 7 Bill, in the Bishop's Stortford Order. Among the Orders in the last-named Bill, is that of Dover; and in it is an extended form of the old Bermondsey clause, which, while it is more comprehensive than that drafted in 1902, also gives the undertakers three years as the period of grace before the clause is to take effect. In the Northumberland clause, as adopted in the other Electric Lighting Orders, five years is the period named. As the provision in the Dover Order supplies us with another variation, its quotation *in extenso* will be useful.

The undertakers shall, once in every year, after the completion of three years from the commencement of this Order, cause to be laid before them an estimate showing the probable financial result of the next ensuing year's working of the undertaking under this Order, and shall thereupon fix the charges to be made for the supply of energy in the then ensuing year; those charges to be calculated so that, as far as reasonably practicable, the revenue of the year shall not be less than the expenditure for that year (including in that expenditure the interest and instalments of capital which will become due during the same year in respect of the same, but not including any expenditure properly chargeable to capital account), and any loss incurred in carrying on the undertaking in that year shall be taken into account and debited in the estimate for the next ensuing year.

Readers who desire to compare the full extent of the variations of this clause from the original can do so by referring

back to the article contributed by Mr. Vincent R. Balfour Browne to the "JOURNAL" for June 30, 1903. But Dover is the only Order of the several to which we have referred in which this particular form of clause appears, though there are points about it which might with advantage be amalgamated in the Northumberland clause of last year. The other Orders mentioned contain, without exception, the Northumberland clause, though certain of them do not embrace the provision as to street lighting. The only remark that need be made upon this is that it is a pity.

However, upon this evidence, the important thing is that there is now little doubt that, when pressed for, the Board of Trade will insert one or other of these forms of clause for the protection of ratepayers. After what was done last year by the Northumberland Committee, and with public opinion so greatly incensed by the financial licentiousness of municipalities, the position of the Board certainly could not have continued tenable much longer. Again persistence has been successful, though the lane to the goal has been a long one, and the barriers to progress in it have been many. There is encouragement here for the gas industry in persevering until they have destroyed the fresh anomaly in gas testing which found its birth in a Committee appointed by the Board.

Trade and Gas Consumption.

The past year is the first occasion for a very long time on which a decrease in the receipts from the sale of gas has been experienced at Burton-upon-Trent. In common with many other places, the effects of bad trade have made themselves felt; while the economy in consumption secured by the use of incandescent burners has, of course, also had its influence on the output. It is to be noted that the falling off in revenue has been entirely due to the ordinary consumers; the income from prepayment supplies showing a gratifying increase on the year. Naturally it has been the large users who have been chiefly affected by prevailing trade conditions, though in times of exceptional depression the prepayment branch might be expected to suffer as well. The stability, however, of the latter class of custom, under anything like ordinary circumstances, is an argument in its favour; while the larger the number of big consumers possessed by an undertaking, the greater will be the effect on the balance-sheet of fluctuations in the state of trade. As to the incandescent light, though the adoption of this system must lead to a lessened demand temporarily, its rapid extension is the best thing that could possibly happen, for it places the gas undertaking on a surer basis, and furnishes it with a weapon with which to defeat all competitors. It must not be inferred, however, from these remarks, that the Burton-upon-Trent Gas-Works have suffered seriously during the past year from the causes mentioned above. On the contrary, the position of the concern is so excellent as to thoroughly justify the congratulations which it was suggested, when the report was considered, should be forwarded to the Engineer and Manager (Mr. F. L. Ramsden). Not only has the customary £5000 been handed over towards the relief of the rates, but, in continuance of the policy inaugurated twelve months ago, a sum of upwards of £4000 has been allocated to a deterioration fund for wiping out the capital outlay on prepayment meters, fittings, and stoves. In addition to this, all expenditure during the past twelve months on prepayment meters and fittings has been charged to revenue.

The Displacement of City Electric Arc Lamps by Gas.

The distinct victory which gas has scored in the City has not been esteemed by those of our electrical contemporaries which have been seen by us as of sufficient importance to be proclaimed with any degree of prominence; and they have kindly allowed the gas industry to rejoice in the success without any attempt at mitigation, such as is the practice of daily papers, according to political view, in the case of bye-elections. In both our editorial and news columns last week, information on the subject was given; and this week, through the courteous compliance of the General Manager of the Gaslight and Coke Company (Mr. D. Milne Watson) with a request made to him, we are in a position to furnish readers with a few more details of the changes involved in the scheme. As was stated in last week's issue, in Fleet Street ordinary incandescent gas-burners are to supersede the electric arc lamps; while in Queen Victoria Street, Queen Street, and Lower Thames Street, incandescent gas-lamps on the high-pressure system are to be installed. Taking Fleet Street first. Twelve electric arc lamps are to be removed; and the scheme contemplates the erection of 31 lamps each containing two "C" burners, and three lamps each fitted with three burners—the gas being supplied at the ordinary district pressure. Queen Victoria Street and Queen Street are at present lighted by 30 electric arc lamps. The adopted plan provides for the erection of 45 gas-lamps, each containing two 300-candle power incandescent burners. In this case, the gas is to be supplied at a higher pressure by means of the Keith-Blackman apparatus (in duplicate), driven by gas-engines. In Lower Thames Street and Monument Street, eight electric arc lamps at present stand; and they are to be discarded in favour of 33 gas-lamps, each fitted with one 300-candle power burner. The gas will be supplied to the lamps under pressure by the Keith-Blackman plant, again in duplicate, but in this case driven by water power. The total effective illuminating power of the gas-lamps to be installed will amount to nearly 42,000 candles, as compared with 25,000 effective candle power provided by the existing arc lamps. Moreover, the latter being placed at a greater height than that at which the gas-lamps will be fixed, the comparison of lighting power (taking an imaginary plane 3 feet from the pavement as being the surface requiring to be efficiently illuminated) will be still more in favour of gas than is indicated by the figures quoted. We may depend upon those who will be responsible for justifying the resolution of the Corporation and for the reputation of gas lighting in these important parts of the City looking well to the maintenance of the lamps at a high-placed mark of efficiency. In the editorial on this subject in last week's JOURNAL, damage to a figure "9" converted it apparently into an "0," so that the estimated cost of supplanting 47 electric lamps by high-pressure and ordinary incandescent gas-lamps looked like £1052, instead of £1952. As this may expose us to the charge of misrepresentation, the explanation should be immediately made, though a study of the subsequent figures in the article would dispel any such notion.

An Unaccepted Invitation.

Much has been said and written of late anent the cultivation of opportunities for pursuing the fight with electricity for new, and the retention of old, possessions, and for retrieving lost ground. Gas has the advantages of cheapness, high efficiency, and manifold use, on its side; so that there need be no fear of encountering the champions of the rival illuminant on every convenient occasion. A good tactician among the officers of a gas company, who can make service of this kind a special duty, is a very desirable person; and anyone who has a particular bent for such work should be given the greatest encouragement. Among local institutions in which mutual service can be rendered are those of the debating and educational order. A Hackney paper conveys to us the intelligence that the activities of Mr. F. W. Goodenough, the Chief Inspector of the Gaslight and Coke Company, have not been exhausted by the great variety of business-developing plans that he has initiated since he has occupied his present important office. May-day saw him taking an aggressive part in opening a discussion, at the meeting of the Borough of Hackney Debating Society, on the subject of "Which is Preferable, Gas or Electricity?" In the hope of obtaining an effective discussion, the honorary organizer of the Society's debates invited the Borough Electrical Engineer and two or three members of the Electric Lighting Committee to be present, with the view of taking the defensive, and not allowing Mr. Goodenough to have a "walk-over." But there are occasions when most people can find comfort in, and can bless the man who invented, the very useful saw that "Discretion is the better part of valour." The representatives of the Borough Electrical Department did not turn up. The statement is sufficient comment. Not only before the members did gas come off victorious, as expressed by the resolution carried "that gas is a cheaper and a better illuminant than electricity," but the local "Mercury" has reported the debate to the extent of two-and-a-half columns; so that its value is not limited to the circle of the Society's membership. Extracts appear elsewhere. A fact that Mr. Goodenough described as "startling," but it will be more so to the electricians than to gas people, will be particularly noted—

"that within the last two years, the Gaslight and Coke Company have taken the electric light out of 1240 premises and reinstated gas." "Energy," as we fancy it has been remarked before in these columns, is not the peculiar possession of electricity.

Contracts and the Fair Wages Clause.

The fair wages clause in contracts is so often heard of now that it comes almost as a surprise to find a proposal to include it in future contracts given out by the Taunton Town Council rejected by a majority of two to one. The fact that the Taunton Trade and Labour Council desired it, and that such a clause was inserted in Government contracts, appeared to be the chief arguments adduced in favour of the adoption in regard to Corporation work of the stipulation that contractors should pay their employees not less than the standard rate of wages and accept the conditions and hours adopted by the various Trade Societies of Taunton. The opponents, however, in the course of a somewhat lively debate, had a great deal to say against the proposal. One member said that it would interfere with the freedom of the subject, and be to the disadvantage of the men. Another remarked that he did not believe in a lot of men saying: "Give us free trade," and then on the other hand crying: "Protect our labour." A third member urged that, as far as the masters were concerned, the clause would not affect them pecuniarily, for it was the ratepayers who would have to pay. It would mean that only men in the prime of life would be employed, and those who were a little bit old, and could not work so fast, would be put off. In a town like Taunton, it was almost impossible to carry out such a system; but in large towns, where there were labour bureaus, it was different. The Mayor pointed out, however, that the Unionists said they as ratepayers had to help pay for the work, and so had a right to say a word as to the terms on which the Corporation made their contracts. The next speaker said he could not see the object of the matter being introduced at all, except that the Trade Union were asking them to become their agents in carrying out a scheme which he did not think at all equitable to the contractors in the town or to the ratepayers. These were merely some of the main contentions advanced against the proposal; but they are quite sufficient to show that at any rate to this question as to others there are two sides. The feeling in favour of Trade Unionism does not seem to be overwhelmingly strong in the Taunton Town Council; but possibly there are reasons for this.

The death occurred on the 7th inst., at Buenos Ayres, after a short illness, of Colonel MELITON PANELO. Deceased, who was in his 61st year, was a native of Buenos Ayres, and was a man of considerable importance there. He was President of the Local Committee of the River Plate Gas Company.

In response to their advertisement, the Devonport Gas Committee have received sixty applications for the position of Manager of the Corporation gas undertaking. These have been considered by the Committee, who selected five to appear before them yesterday. The appointment will be finally made by the Council to-day.

The Directors of the Wellington (Salop) Gas Company have had under consideration the applications for the position of Manager, in succession to Mr. Herman Taplay, resigned, submitted in response to the invitation which appeared a few weeks ago in our advertisement columns, and we learn that they have selected Mr. HENRY J. WOODFINE, of the Wallasey Gas-Works.

The death occurred last Thursday, at his residence at West Ealing, in his 60th year, of Mr. FRANK HENRY WYBROO, who was for twelve years the Secretary of the West Middlesex Water Company; having succeeded Mr. G. B. Hall, on his retirement in 1902. On the formation of the Staines Reservoirs Joint Committee, of which this was one of the constituent Companies, he was entrusted with the secretarial duties. The two undertakings, as our readers are aware, have been in the hands of the Metropolitan Water Board since June last year. The interment takes place to-day in Perivale Churchyard.

Mr. SIDNEY E. STEVENSON, the late Manager of the Devonport Gas-Works, was presented on Thursday last with a testimonial of the esteem in which he is held by the employees. It consisted of a handsome silver-mounted smoker's cabinet, and was subscribed for by all those with whom Mr. Stevenson has been associated at the works. Opportunity was also taken of the occasion to present Mrs. Stevenson with a silver epergne and a pair of vases. At the meeting at which the presentations were made, testimony was borne to the good feeling which has existed between Mr. Stevenson and the officials and workmen during the five years in which they have been together.

NOTES FROM WESTMINSTER.

COMMITTEES of both Houses were at work last week; but, with one exception, gas was absent. Lord Camperdown's Committee, sitting in the Grand Committee Hall, made quite an enormous progress with the group of London Electric Bills. Other Committees of the Lords on Thursday entered upon the consideration of the water sections of the Mansfield Corporation Bill and of the Bangor Improvement Bill. The latter also contains a section referring to the extension of the gas-works. The Skegness Water Bill was also taken in hand the same day. At the time of preparing these "Notes," the three latter Bills were still under discussion; and therefore further reference is deferred.

Gas Supply at Crewe. It is impossible to view with the slightest degree of sympathy the second defeat which the London and North-Western Railway Company have incurred within three sessions over the peculiar position they desire to be placed in in relation to the supply of gas of Crewe. After having enjoyed a unique power of gas supply in the borough for something like forty years, they have twice endeavoured to persuade Parliament to let them root themselves deeper in the town without taking upon themselves the responsibilities to which all other statutory gas companies have to submit. Under their Act of 1880, the Company have a perpetual power of gas supply in Crewe, though not a monopoly; and they are not subject to any obligations whatsoever. In 1903, however, they asked a Committee of which Lord Camperdown was Chairman to grant them the provisions of the Gas-Works Clauses Act of 1847 with respect to the breaking up of streets, but nothing else. The Corporation then opposed the ceding of the power without the imposition of all the other obligations of statutory gas suppliers. Their requisition that the granting of such an important right should be accompanied by the ordinary protection of the local authority and of the consumers, was perfectly reasonable; and so it appeared to Lord Camperdown and his colleagues, who refused the power sought by the Railway Company. It was precisely the same clause that the Company introduced into their Bill this year; and they appealed to Parliament to allow it, on exactly the same case as three sessions since, except that they sought to show that the Corporation since 1903 had endeavoured to restrict their liberty in the matter of opening the streets. The Company's case alone satisfied the Committee that there had been no change in the conditions since 1903 to justify any departure from the decision of Lord Camperdown's Committee. However, sufficient was heard from Mr. Honoratus Lloyd, K.C., who (with Mr. Jeeves) represented the Corporation, collaborating with Mr. Corbet Woodall, to learn that the Corporation took the same grounds of objection as they did on the former occasion. The position of Crewe in respect of its gas supply is altogether anomalous; and after this second attempt to secure one-sided terms by the Railway Company, and the statement of Sir Ralph Littler (who appeared for the Company) "that the people of Crewe would not get much gas in the future," it is high time that the Railway Company should be placed under proper regulation. It is evident that the gas consumers and inhabitants of the place are at their mercy if, for any reason, they chose to discontinue the supply; as a matter of fact, they are not under any obligation to supply any consumer. We do not say they have abused their powers of supply up to the present; but, for a town of the status of Crewe, the existing arrangement is an altogether unsatisfactory one.

The London Electrical Bills. Reassembling on Tuesday, Lord Camperdown's Committee entered upon the consideration of the second Bill in their group—the City of London Electric Lighting Company (Extension of Powers) Bill; and, by the time they rose on Friday, they had had before them the Charing Cross and Strand Electricity Supply Corporation Bill, and that of the Metropolitan Electric Supply Company (Various Powers) Bill. All these are power and supply-in-bulk Bills. It will be remembered that, in regard to the Administrative County of London Bill, both the cases for the promoters and opposition were disposed of before the Easter recess; and now only the decision of the Committee is awaited. The reason for the course of procedure adopted by the Committee last week is the subject of considerable speculation. They have heard the cases of the promoters of the three Bills alluded to in the opening lines, but have on all "postponed" hearing the cases of the opposition. The explanation of this is probably that the Committee are of opinion that the lines the numerous opponents would take would necessarily follow almost precisely those which were pursued by them in dealing with the Administrative County of London Company's measure. Since the Bills were first introduced, that of the East London and Lower Thames Company has been amalgamated with the one promoted by the City of London Electric Lighting Company; and an area of supply is mapped out comprising some 295 square miles. Yet this takes second place to the Administrative Company's Bill in the matter of territory. We are not inclined to go into the details of this or the other two measures that were under consideration during the week. The Bills cannot all succeed; and there is—excepting in the matter of area, works, and in each promoter's scheme being, of course, better than those which have preceded—a great similarity in what they are proposing to do, and the "benefits"

they intend to confer. The London County Council are pleading that there is no justification for these projects, and that they will only stand in the way of a complete scheme which the Council and the Borough Authorities may combine to provide in the future. The Committee can hardly pay much attention to a nebulous suggestion of this kind. There are definite schemes before them; and London is covered with electrical supplies at the present time working under statutory authority, and quite competent (so leading engineers say) to give all in the way of electrical energy that is required. The broad question has first of all to be determined whether the undertakings that now exist are sufficient. If the Committee are of opinion that they are, there will be an end to the proposed new companies; if they think otherwise, then—well we do not envy them the responsibility that will fall upon their shoulders.

The Northumberland Clause. An article on the change of attitude of the Board of Trade on this question appears in our editorial columns. The information it conveys is of the utmost importance to gas companies, in their dual position of ratepayers and business competitors desiring fair play.

Bolton Water. After considerable argument, the preamble of the Bolton Corporation Bill, which, it will be remembered, was under consideration by Sir Joseph Leese's Committee before Easter, has been declared proved—a clause in favour of Darwen having been arranged which meets with the approval of the Committee. It provides that, at the expiration of a period of eight years from the passing of the Act, the Bolton Corporation shall supply to the Corporation of Darwen, at such a point on the boundary of the borough of Darwen as the latter may reasonably require, 300,000 gallons of water a day; the price to be paid for the water, if not agreed upon, to be determined by a water engineer appointed for the purpose by the Local Government Board.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 455.)

THE Stock Exchange has had another highly unpleasant week, although the worst of it was over before the close. The opening was gloomy in the extreme. The nervousness regarding relations between France and Japan, the lack of information as to what was really going on in the Eastern seas, and the alarm produced by the Hawkins failure lest further large difficulties should come to light in the impending settlement—all these conspired to exert a most depressing influence. Consols at one time were down to 89½. The next day tension was slightly relaxed, and the position was fairly maintained until the settlement was completed without any crash discovering itself. Then the market breathed a little more freely, and there was a pause for reflection until the close. In the Money Market, there was a good, strong demand for short loans at firm rates; and discount rates were steady, but inclined to be easier if anything. Business in the Gas Market was fairly abundant on the whole, but somewhat fitful and irregular. Some issues would suddenly have a burst of activity, and then subside into inaction for days. The tendency on the whole was favourable, especially when the general depression ruling in other departments is considered. In Gaslight and Coke, the ordinary was brisk and buoyant, and further improved upon its advance of the preceding week. On Monday, when everything was flat, it was marked at 97, but soon rose until on Saturday it touched 99¼. Of the secured issues, the preference was done at from 109¼ to 110½, and the debenture at from 90 to 91¾. South Metropolitan was not much dealt in, but ruled very steady. The first price was 127¾, and the last 128½. The debenture was marked twice at 91. In Commercials, some unexplained influence was at work to depress the prices, and it had a limited success. One transaction was marked in the 4 per cent. at 111½. There was more business doing than of late in the Suburban and Provincial group, and a few changes in quotation. Bournemouth "B" marked 16⅞, and ditto preference 16. Brighton original changed hands at 228, and ditto ordinary at 167 and 167¾d. British was half-a-point easier at 41. South Suburban was done at 120¼ and 121½, and West Ham preference at 123½. Among the Continental Companies, there was considerable activity in European, which had long been quiescent, and many transactions were marked in the part-paid shares at from 15⅜ to 15¾. Imperial changed hands at from 219½ to 221 *cum div.*, and from 214 to 215½ *ex div.* Union was done once at 110. Malta marked an advance at 4 7/32 and 4 9/16. Among the undertakings of the remoter world, Bombay new marked 5¼ and 5⅜ *cum div.*; and a small parcel of Oriental was done "free" at 149. Buenos Ayres fetched 12⅛ *ex div.*, and ditto debenture 96½ and 96¾. Monte Video marked 12 and 12⅛. Primitiva ordinary was done at 6 and 6 1/16, ditto preference at from 5 3/16 to 5⅜, and ditto debenture at 97. River Plate eased down from 12¼ to 11 13/16. Hong Kong was done at 16⅞, and Melbourne 5 per cent. bonds at 101½.

The closing prices are shown in our Stock and Share List on p. 455.

ELECTRIC LIGHTING MEMORANDA.

Municipal Electricity Finance—Losses and Depreciation—Mr. Robert Hammond Seeks Favour at Dublin—Our Sudbury Critic—The Torquay Muddle.

THE truth is not always a palatable thing. It is not, for example, to the taste of many municipalities to be told that their financial policy, in connection with their electricity undertakings, has a most unstable base. A writer on the subject in the "Municipal Journal" tells us that the real problem facing municipal electrical undertakings is a financial one; and a sound and well-considered policy should be decided upon, and consistently adhered to. Other sentient folk have said much the same thing before this writer. There is truth in the first part of the statement; and very proper advice in the second. But it is not an agreeable thing to those who try to hide the blemishes of their electrical finances, to have the truth so constantly and deliberately thrown in their faces; and to pour the advice into their ears that they should adopt and adhere to a sound and well-considered policy, has just about the same effect as pouring water upon a duck's back. In many instances, there will never be any adoption of a sound financial policy, unless it is made a matter of compulsion. However, the same writer makes another remark, which, among several other points, strikes the attention. It is that "the question of depreciation has reached an acute stage with many of the undertakings which have been at work about ten years." Depreciation is a sore point with many municipal purveyors of electricity, because if they did the correct thing in this way, in view of the susceptibility of electrical plant to somewhat active decline, there would be more undertakings than there are at present showing balances on the wrong side of their accounts.

A useful leaflet which throws light on these questions has been issued by the Industrial Freedom League. In it, the unprofitable character of a large number of municipal undertakings, and the almost general inadequacy of the allocations for depreciation, are given rather hideous and alarming form by the figures being massed together. We have it set forth with perspicuity that on March 31 last year, there had been working for twelve months or more, 190 electric light undertakings, of which 116 claim to have made a "profit" and 74 admit a loss. With an aggregate capital expenditure of £26,924,888, there was a so-called profit of £419,984, which is equal to the magnificent percentage on the capital employed of 1½, after the necessary provision had been made for interest and sinking fund. Another highly interesting fact is that, of this "profit," more than half—£214,798—was made by eleven of the 116 local authorities on a capital expenditure of £8,614,650; so that, if the balance of "profit," amounting to £205,186, is spread over the remainder of the capital expenditure—that is to say, £18,310,238—it will be seen that it was earning slightly over 1 per cent. We have also the doleful information that losses amounting to £80,504 were made in respect of 74 undertakings; yet considerably more than half of these undertakings had been in operation for periods varying from 3 to 21 years. The receipts of five of the number were not sufficient to cover their working expenses. Concerning inadequate depreciation, it is seen that in the year the total sum placed to reserve and depreciation amounted to £268,657, or an equivalent of 1 per cent. on the total capital expended. A modest allowance of 2½ per cent. for depreciation on the capital expenditure of £26,924,888 (all of which cannot be considered as now productive) would amount to £673,122. Of the total of 190 authorities, it is to be regretted that only 69 made provision of any kind. We will only quote one other fact from this compilation of municipal transgression in the matter of electrical finance. It is this that of the fourteen Borough Councils supplying electricity in the County of London, certain of them received in 1903-4 contributions from the rates amounting to £39,518, while the others only contributed £14,647 to the rates. There is a considerable balance on the wrong side here.

An echo of the recent unrest in Dublin over affairs electrical was heard at the meeting of the Corporation last week; and it calls for notice as being in the nature of a sequel to the tale which we have followed in the "Memoranda." It appears that a spirit of sweet reasonableness on the part of Mr. Robert Hammond is likely to enable the Dublin Corporation Electric Lighting Committee to determine with their advising and supervising Electrical Engineer the somewhat indefinite agreement with him of 1899. The Council have frequently expressed the wish to effect some finality in regard to that agreement, and to put an end to the payment of the 5 per cent. commission and travelling and other expenses, between London and Dublin, upon matters which can well be carried out by the Corporation's own staff. From this, one gets an impression (which should be corrected if not true) that Mr. Robert Hammond has not been negligent in the matter of looking after the recompense for all sorts and conditions of work that has been done during his electrical headship in Dublin. A proposal of the Electric Lighting Committee, that the Corporation and Mr. Hammond should dissolve their relationship was waiting to be brought before the Council, when a letter was received from the firm of which Mr. Hammond is the chief, suggesting that—as there are many matters which should still have the Consulting Engineer's attention in connection with the constructional and other work which has been carried out under his direction in Dublin—instead of determining the agreement at once, a formal agreement should be entered into making the one

of 1899 apply purely to work already in hand, and to leave the Council free to deal with the matter of future extensions of the undertaking as they may deem desirable. The Committee are looking favourably upon this proposal, but they have not settled the matter yet. The *via media* proposed by Mr. Hammond is a clever idea; and, with an eye to the future, he must regard it as a good piece of business if he succeeds in maintaining a connection, however slight, with Dublin. When the sarcasm is remembered that in Dublin has been heaped on the name of Hammond and on certain claims of remarkable achievement, one wonders how the head of the house of Hammond regards those poor mortals who, endowed with an ordinary degree of sensitiveness, would have shrunk from a continuance of relations with a body who had similarly dealt out, over personal work, detraction with acerbity and unsparing tongue.

The gentleman who presides over the "Jottings" in the "News" published at Sudbury (it is hoped we have not done the Editor an injustice in believing him to be the person) has been worked up to such a state of excitement over our comments last week that he has had to relieve his feelings to the length of fourteen jottings—constituting a most amusing tirade against the "JOURNAL." If he can be irritated in this way into retort, it is worth seeing whether we can bring him to book on more solid matter, for which he has this week given us an opening, which is the thing desired. But first of all let us say that the gentleman in question must really be a personage of considerable importance, notwithstanding that he edits Sudbury's news, as we find that he waves aside, in an airy and contemptuous manner, the actions of the Board of Trade, the Local Government Board, and the decision of Mr. Justice Warrington—combining which actions and decision presents us with one of the most striking condemnations of municipal bungling that it has ever been our lot to witness. The Editor of the "News" is surely the man to get the Corporation out of the mess into which they have fallen. Our critic informs us now that the Local Government Board stated that they regarded the electricity scheme as generally satisfactory, but that, as the margin of borrowing power available to the Town Council was insufficient, they were unable, at the present time, to sanction the loan. In the previous week this gentleman, who likes "facts," asserted that "the town had exceeded its borrowing powers," which does not suggest the existence of any really available margin. It was extremely kind of the Local Government Board to treat the Corporation so courteously as to describe their scheme as "generally satisfactory;" but this does not necessarily mean that they regard the financial prospects as satisfactory. We attach far more importance to the act of refusal than to the words of the letter.

The Editor objects to "assumptions," "errors," "logomachy," and "dust-throwing," such as he discovers in our criticism, and we plentifully in his. So away with all these things; and let us get to matters which we hope will be beneficially productive. "It is part of the case," says the wrathful Editor, "of the opponents of electricity that, in a large number of cases, electric lighting schemes have proved great losses. These schemes were submitted to the Local Government Inspectors, who, according to our contemporary, calculated the conditions and probabilities of success." The point as to the losses is true; and it is because some years of trial have shown that, excepting in districts favourably circumstanced, these losses have been a serious burden on the ratepayers, that within the last year or two the Local Government Board have refused in certain cases to grant the necessary borrowing powers for electricity schemes. But "as a matter of fact," observes the dogmatic writer of "jottings," "what were represented as 'losses' were not losses at all." Good! Will he supply the names of the towns to which he alludes? Then he goes on to speak about "mendacious manipulation of figures," and gives vent to other disagreeable remarks. In discussing this question of losses, we must take things as they are. Municipal undertakings are run on borrowed money; and the principal must be repaid and interest provided within a term of years representing the life—and for certain plant unfortunately more than the life—of the subject. Any deficiency, after meeting all obligations, is therefore a loss, for which the ratepayers are responsible. Now perhaps this fountain of "knowledge" will tell us whether or not the deficits standing, in the last available returns, against some sixty municipal undertakings, after paying principal and interest, are "losses" to the ratepayers. And those deficits do not represent the total loss when the increased cost of public lighting by electricity which the ratepayers have to meet is taken into account. If the names of these towns are not within his knowledge, we will supply a number as examples, and put to a test his accusation of "a mendacious manipulation of figures." It is only fair, after his statements this week, that he should accept the challenge. By the way, it is noticed that he is silent on our criticism of the grotesque analogy he essayed to establish between electricity and sewerage works. Humorous Editor!

The tangle into which the Torquay Corporation have got themselves by entering into a rash agreement with the Dolter Tramway Company for the supply of current, without safeguarding themselves before ascertaining whether the Local Government Board would grant them a loan for the construction of the necessary new electricity works, has not been made the less embarrassing by the opinion that the Corporation have obtained from Mr. H. T. Eve, K.C., as to their liability in the event of, in the circumstances, their non-feasance in respect of their part of the agreement. Mr. Eve is distinctly of opinion that the Company would have ground for action; and the measure of damages would be the difference of cost to the Company in obtaining their motive power from some other source, or from works of their own which would have to be erected at considerable outlay. The Council have passed a resolution, appealing to the Local Government Board to consider the position in which the Corporation are placed by reason of the agreement, and to allow the sanction to the £42,000, less the sum required for the erection of a "combined" chimney. The infinity of the muddles and troubles of municipal electricity supply affords never-failing interest.

THE PROPOSED MUNICIPALIZATION OF THE MILAN GAS-WORKS.

OUR issue of the 2nd inst. contained a short paragraph reporting the fact that the Town Council of Milan had rejected the proposal to municipalize the gas-works there, which belong to the Compagnie L'Union des Gaz. We have since received copies of the local Italian papers, and are now enabled to give therefrom further information on the subject. Two reports have been prepared, one, which may be called the official one, drawn up on the nomination of the Syndic, by the Moderate party in power on the Town Council, and the other by the Socialist party, who are in a minority. It is with this latter report—or, as it is termed, counter-report—that we are now dealing. It begins by referring to considerations of time which prevented the separate examination of the plant of the Union des Gaz, and further to the necessity of a careful study of the cost of manufacture, and the amount of the indemnity to be paid to the Company. The arguments and figures of the official report are called in question, and the average cost of coal, which had been taken at 30 lire per ton, could, it is considered, be reduced to 29 lire as an average basis for calculation. As regards the make of gas and coke, however, the counter-report agrees with the official one; and also, too, as regards the figures of the bye-products, with, however, a reservation as to the price realized for tar.

Passing to the cost of manufacture, the minority report is based on the last balance-sheet of the Union des Gaz, which shows a total for production, upkeep, and general expenses of 2,645,526 lire. This works out to 16·23 lire per ton of coal carbonized, as compared with the figure of 18·109 lire, given in the Commission's report. Applying the coefficients taken in the counter-report, the totals arrived at are—

Revenue	10,877,619·47 lire.
Expenditure	9,183,755 83 ,,
Profits for year 1903-4 . . .	1,693,863·64 lire.

From this estimate comes the cost of the make of gas, including everything except capital—namely, 8·607c. per cubic metre of gas consumed, as compared with 10·121c., the resulting cost given by the Commission.

In the valuation of the purchase price, the counter-report proceeds carefully, and its signatories are not desirous of entering into discussion on the matter. But they state that the valuation formerly given was not in detail, especially as regards the most important part of the plant—that of the works themselves. Figures relating to the gas-distributing system are, however, discussed, and the sum of 28,500,000 lire is reduced to 25,000,000 lire, suggesting at the same time a reference to arbitration to decide the exact indemnity to be paid, in accordance with the law. Passing then to an estimate of the profits accruing from the working, the counter-report shows on the credit side 2,620,000 lire, and on the debit side 1,220,000 lire; leaving a net yearly profit of 1,400,000 lire in place of only 617,028 lire, as given in the official report. After allowing for an annual amortisement during twenty years, valued at 498,303·63 lire, this would leave an annual profit to the town of about 900,000 lire, instead of 127,724·37 lire, which was the result of the Commission's calculations. The counter-report also draws attention to there being no obligation to redeem in only twenty years, and points out that by extending this period the annual net profit might reach 1,000,000 lire.

After referring to the advantages that would also accrue from the immediate reduction in the price of gas to 13c. per cubic metre, and combating the contention of the official report that the probable annual increase of 2 million cubic metres was to be regarded as a burden rather than a source of economical amelioration, the councillors of the minority conclude their report by saying they had wished "simply to show that their scheme for the municipalization of the gas undertaking did not emanate from a party committed to proceed with it at any cost, but rather from the conviction that the proposal would be economically advantageous to the commune and to the consumers, and was worthy of being thoroughly investigated before being definitely thrown back."

This, then, is a bare outline of the report which came up for consideration at a crowded and excited meeting of the Town Council of Milan on the 27th ult. The discussion was opened by Signor Brugnatelli, of the Socialist party, who explained that he had declined to be on the Commission, which had been elected in such furious haste, because fifteen or twenty days were not

enough in which to study so serious a question. Signor de Marchi, who was the framer of the official report, disputed the accuracy of the figures in the counter-report. On the other hand, Signor Ing. Manfredini, representing the minority's report, defended its calculations and supported its conclusions. Signor Besana said the gas question necessitated still further and better investigation. He had little confidence in the figures of Signor De Marchi's report, nor even in those of his colleagues in the minority. Signor Luraschi confirmed the general regret at not being able to effect the municipalization of the gas undertaking, but it would prove a fresh burden on the exhausted finances of the Commune rather than a relief. The last word in the discussion lay with the Assessors of the Municipality, Signori Ponzio, Saldini, and Della Porta. The first named voiced the opinions of all. He destroyed the legend that the authorities were against municipalization; he personally was very favourable to it. But he asked, Why do it now, when they had a larger number of years to give compensation for, with the expense of improving and repairing the works and other burdens, which would be able to be done more advantageously within a quinquennial period? This was why the Committee did not propose to municipalize the gas service now. He could not accept the proposals of the minority report either on technical or moral grounds. The following resolution was then put to the meeting and carried by 46 votes: "The Town Council, having heard the declarations of the Committee, agrees with them that, while it would be very desirable for the Municipality to take over the direct control of the gas lighting service, such undertaking, under the actual circumstances, is neither convenient nor opportune, and passes to the order of the day."

THE ORGANIZATION OF LABOUR.

THERE has of late been a very great deal of attention bestowed upon the extremely important subject of Trade Unionism as practised in this country. This has without doubt been owing mainly to the far-reaching decision of the House of Lords in the celebrated Taff Vale case, which, by holding that Unions are legally liable for the actions of their officers (though in another case since before the Court of Appeal it has been decided that the particular Union therein concerned were not liable because the plaintiff had failed to show any authority of the Union for the acts complained of), has entirely changed the position of affairs —for the better many people are inclined to think, but for the worse as their adherents are naturally disposed to believe. Other cases have operated to still further restrain the actions of the Unions, and have greatly crippled their power as fighting machines.

Only a few weeks ago reference was made in the "JOURNAL" to two notable judgments of the House of Lords, both adverse to the Societies involved. By the first of these, the South Wales Miners' Federation were held liable for damage caused to certain colliery owners through their attempt to restrict output by ordering the men to abstain from work on certain days—"stop" days —against the wishes of (or without consulting) their employers; while by the second the Yorkshire Miners' Association were restrained from distributing strike pay to men who ceased work under circumstances which, according to the rules of the Association, did not entitle them to receive it. In the Taff Vale case, of course, the Amalgamated Society of Railway Servants were condemned to pay heavy damages as the result of injury caused by "watching and besetting" carried on, under their authority, during a dispute which the Railway Company had with their employees. In other cases, also, it has been held that picketing, except to obtain or convey information, is illegal; and that it is actionable for a Union to call out their members because an employer refuses to discharge non-Unionists. The altered condition of affairs thus created, the Labour leaders are by no means content to submit to without a struggle; and hence the strong efforts which have been, and are now being, made to procure from Parliament special legislation which would place the Unions in something like the position which they imagined they occupied before the numerous unfavourable decisions just referred to. With this object, the Trade Unions and Trade Disputes Bill was introduced in the present session, following previous similar proposals. This measure (the provisions of which have been duly set forth in our pages) passed the second reading some time ago, and was referred to the Standing Committee on Law. While therefore the whole subject is so prominently before the public, it will be of particular interest to those employers, and others in any way concerned with the labour question, who may not already have done so, to make themselves acquainted with the past history and present position of Trade Unionism; and we can imagine no easier method of accomplishing this end than by the study of a small book dealing with the matter which has just been written by Mr. Geoffrey Drage.*

Unfortunately for their popularity outside the ranks of the members, the good work of the Unions has perforce been overshadowed by the ill-advised tactics which have far too often been resorted to. In judging the Societies, however, all the circumstances should be taken into consideration; and this is precisely what Mr. Drage has done. He remarks that one prevalent fallacy seems to be that a Trade Union exists solely to foster strikes, harass employers, and hamper industry; but if this is so, the officials themselves are mainly to blame, for they have done a good deal to create such a mistaken opinion. That a very large proportion of the income of the Unions has been spent in sick and other benefits, and a comparatively small percentage on labour disputes, is known to all who study the Government returns. But this was under the old condition of affairs. Now that the Union funds are liable to be drawn upon to make good damage caused to employers by the actions of officials, the militant side of the business will become more expensive than has hitherto been the case, unless greater care is exercised than has heretofore been shown in the conduct of labour disputes. In so far as Trade Unions fulfil the office of provident societies, their influence can only be for good; and there can be no desire to limit their powers in this direction. This is the reason why the suggestion that the provident funds and fighting funds should be separated has been made in several quarters—notably by Sir George Livesey in his evidence before the Royal Commission on Trade Disputes, and by the Attorney-General in the course of the recent debate on the second reading of the Trade Unions and Trade Disputes Bill already referred to.

We cannot follow Mr. Drage at any length in what he claims is an attempt to hold the balance level between the two parties to the Labour Contract—the employee and the employed. The subject is, as he remarks, a difficult one; but he has stated the facts in as plain a manner as is possible. The first chapter treats of the history and extent of Trade Unions, and the next with their organization and functions. In the latter those who are not familiar with the meaning of the terms Old Unionism and New Unionism will find enlightenment. The distinction does not arise from the date of establishment, but from the objects aimed at and the means employed in carrying them out. As an example of the Old Unions, the United Society of Boilermakers and Iron and Steel Shipbuilders is quoted. The rules of this Society state that the objects are "the establishment of a fund for the relief of its members in sickness, with medical and surgical aid, assistance to members out of employment, accidents, old age, for the interment of its deceased members and their wives." As an instance of the New Unionism, attention is drawn to our friend the National Union of Gas Workers and General Labourers, whose objects are: "To shorten hours of labour, and to obtain wherever possible an eight-hour working day. To abolish wherever possible overtime and Sunday labour, or, where this is not possible, to obtain their payment at an extra charge. To raise wages, and to obtain for the same work the same wages for women as for men. To abolish all illegal fines. To abolish the present system of contracts and agreements between employer and employed. To settle all labour disputes by amicable agreements or arbitration whenever possible. To obtain equality of employer and employed before the law. To obtain legislation for the bettering of the lives of the working class. To obtain these objects there shall be established a general fund for the protection and support of all members of the Union, by weekly payment to them of 10s. to men and 5s. to women, during labour disputes." The wide difference between this somewhat ambitious programme and that of the first-named Union will be readily appreciated.

Mr. Drage also devotes chapters to the larger organizations of Trade Unions—federations and trades councils; the history, constitution, and functions of the Trade Union Congress; and the action and influence of Trade Unions—the advantages to their members, their influence upon the relations of workmen and employers and upon the development and prosperity of trade, &c. The usefulness of the work is considerably enhanced by the addition of an appendix briefly recounting recent legal decisions bearing on the subject with which it deals, and a postscript containing the provisions of the Trade Unions and Trade Disputes Bill, 1905, and a concise account of the debate which took place in the House of Commons on March 10 on the occasion of the second reading of the measure.

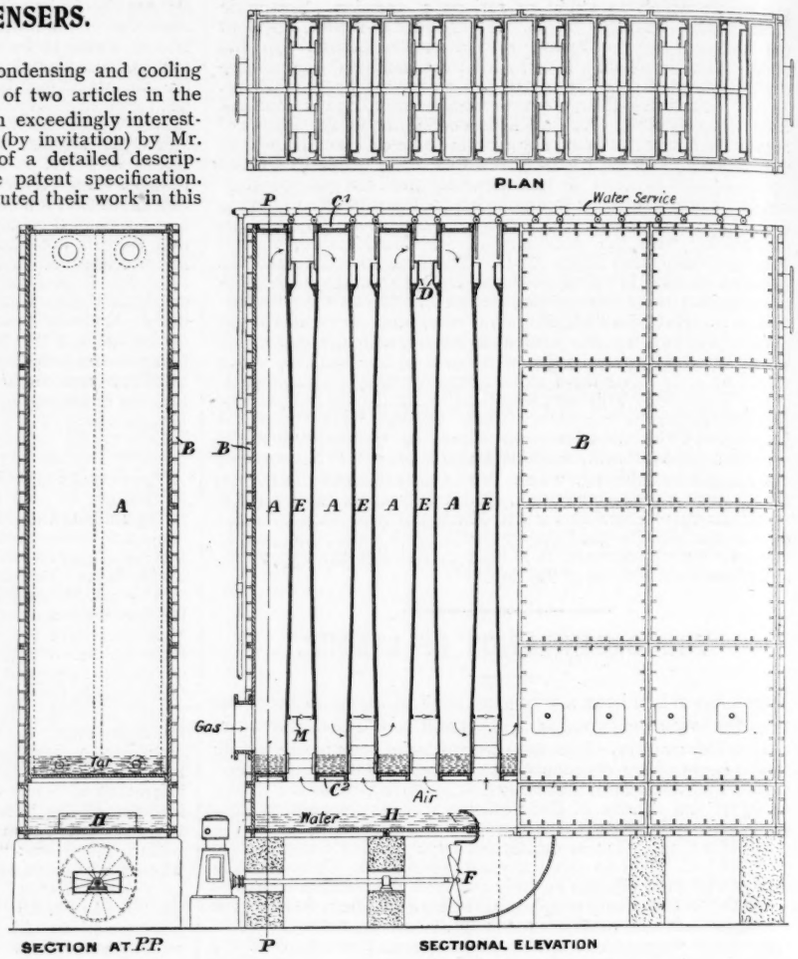
* "Trades Unions." "Books on Business" Series. By Geoffrey Drage. London: Methuen and Co.; 1905.

Mr. J. Horsley Palmer, the Chairman of the Imperial Continental Gas Association, who is a member of the Mercers' Company, has presented a panel by Mr. W. F. Yeames, R.A., depicting "the foundation of St. Paul's School by Dean Colet," to the Gresham Committee for the ambulatory of the Royal Exchange; and it will be publicly unveiled on the 30th inst.

At the first sitting of the 36th annual meeting of the Iron and Steel Institute last Thursday, the Secretary (Mr. Bennett H. Brough) read the report of the Committee, in which it was stated that during the past twelve months 213 members had been elected. The number at the close of the year was 1910; while the addition of those elected at the present meeting made the total about 2000. During the year the deaths had occurred of 41 prominent members, including Sir Lowthian Bell, one of the founders of the Institute and a Past-President; and another was removed by the death of Sir Bernhard Samuelson, F.R.S., the previous day. The financial prosperity of the Institute was stated to be a matter for congratulation, and its position in all other respects satisfactory.

"VAPORIZING" CONDENSERS.

The Browne and Chandler system of condensing and cooling gas, vapours, and liquids was the subject of two articles in the "JOURNAL" for Aug. 23 last. One was an exceedingly interesting and instructive contribution prepared (by invitation) by Mr. A. F. Browne; the other was composed of a detailed description of the process prepared from the patent specification. Messrs. Browne and Chandler have prosecuted their work in this direction, with the result that they have produced an additional type of the "vaporizing" condenser, which we have pleasure in illustrating. If readers will take the trouble to refer back to the articles previously published, in order to refresh their memories, the barest description, in conjunction with the illustration, will suffice at the present time.



In this development, the condenser consists of a series of narrow steel chambers A, carrying the gas, and contained within a cast-iron shell, B. The chambers are suitably spaced apart by means of cast-iron plates C^1 C^2. The chambers are constructed of steel plates and angle-irons, and are built to give a concave surface on the gas side. Upon the convex surfaces or air side, canvas is stretched in the vertical direction and, being continuously fed with water from a shallow cast-iron trough D, constitutes the evaporating surface. The spaces E, between the gas chambers, constitute uptakes for the aqueous vapour or steam given off, the rapid expulsion of which is achieved by means of an air-current produced by the fan F, which air-current, entering at the bottom of each uptake, passes to the atmosphere direct at the top.

The canvas is stretched over the convex surfaces by means of steel grip bars, with tightening screws, to which the canvas is attached at its upper and lower extremities. The surplus water trickling from the canvas drops to the bottom of the condenser into a shallow reservoir, H. This water, by the interposition of cooling-tanks, may be returned to the condenser, if desired. The reservoir itself is in great measure a cooling-tank, because it serves as a conduit for distributing the air throughout the condenser.

The volume of air passing through each uptake is controlled by the valve M. The fan employed is of the propeller disc type; the size suitable for a condenser of a million cubic feet per day being 36 inches diameter, and requiring about 2 brake horse power to drive it. It should be mentioned that this, like other types of the "vaporizing" condenser, is reversible.

JUNIOR INSTITUTION OF ENGINEERS.

The members of this Institution, to the number of about a hundred, visited Dorking last Saturday afternoon, accompanied by the Vice-Chairman (Mr. Adam Hunter) and the Secretary (Mr. Walter T. Dunn), and inspected the gas, water, and electricity works. The party were conducted round the gas-works by Mr. Samuel Carpenter, the Engineer and Manager of the Gas Company, who is the President for the year of the Southern District Association of Gas Engineers and Managers; Mr. G. H. Hughes and Mr. C. Lakin Smith taking charge of them on their arrival at the other works named. The following are the chief features of interest to which attention was called.

The gas-works are the property of the Dorking Gas Company, which was formed in 1834, incorporated in 1871, and obtained additional powers in 1901. Up to the present time, 25½ miles of mains have been laid. The works have recently been enlarged and brought up to date; exhausting plant and a station meter, and the balance of the retort-settings (which are fired on the regenerative principle) having still to be erected. The capacity of the works is 100 million cubic feet per annum. The coals are stacked 24 feet high in front of the retorts by a single chain elevator and band conveyor; the motive power being a 13 brake horse power gas-engine. There are two exhausters of 10,000 cubic feet capacity per hour, of the Beale direct type, worked by steam. The condenser is a horizontal water-tube one of the well known Morris and Cutler pattern. The washer and scrubbing plant is of the vertical chamber type. Light tars, sulphuretted hydrogen, and carbonic acid are removed in Nos. 1 and 2 chambers by ammoniacal liquor; while Nos. 3, 4, and 5 are for the removal of ammonia by water. The purifiers, four in number, are of the luteless type, fitted with Milbourne rapid fasteners. There are three gasholders with a total capacity of 420,000 cubic feet; the latest one being in a steel tank 95 feet diameter by 23 feet deep, and of Messrs. Cutler's make. The sulphate of ammonia plant has a capacity of a ton per day. Walker's still and Taylor's saturator are used. The water supply and tar and liquor pumps (4000 gallons per hour capacity) are driven by a 7 brake horse power gas-engine. A Humphreys and Glasgow water-gas plant (150,000 cubic feet per day capacity) has been installed. The two blowing engines are steam-driven, and of 20 indicated horse power. The relief holder is of the Gadd and Mason type, and of 20,000 cubic feet capacity. There are three boilers. Two are of 25-horse power; the other being of 10-horse power, and used in connection with the sulphate of ammonia plant. The boiler feed, oil-pumps, &c., are of the Worthington steam type. The governors, three in number, are of the Cowan, Parkinson, and Gas Meter Company's types. In the laboratory a Letheby photometer is used for testing; and there is also a Simmance and Abady calorimeter.

In connection with the water supply there are about 50 miles of distributing mains. There are eight artesian wells, the overflow and discharge water from which passes into an underground collecting reservoir of 200,000 gallons capacity, 70 ft. by 40 ft. by 12 ft. deep. Water is drawn from the collecting reservoir by a set of treble horizontal ram-pumps, and forced through about 2000 yards of 9-inch mains to a high-level reservoir at Tower Hill; a total lift of about 295 feet. The pumps are driven by a high-pressure tandem compound engine of 100 indicated horse power. Steam is supplied by two Lancashire boilers 20 feet long by 6 ft. 6 in. diameter. The capacity of the plant is 30,000 gallons of water pumped per hour. A low-level zone of the district is supplied by springs on the Rookery Estate, about 2 miles distant; the water flowing by gravitation. Another source of supply by gravitation is from the Redlands springs, which are at a high level, and flow into and through a polarite filter before entering the highest reservoir at Tower Hill. There are also two other pumping-stations, which are now closed down, and retained only as a reserve.

The electricity works at the present time furnish current to 230 consumers; the supply being equivalent to 7366 8-candle lamps. A further 300 lamps are awaiting connection. The station, completed in April of last year, is one of those established by Edmundson's Electricity Supply Corporation, who erected it for the Urban Council, and now lease it from them; the Council having the option of taking it over subsequently.

At the conclusion of the visits high-tea was partaken of. The close of the repast was a fitting opportunity to convey to the three gentlemen named above, and to their various assistants, the thanks of the members for their courtesy in arranging for the visits, and for the information furnished. The inspection was much enjoyed and greatly appreciated by everyone present.

ROBERT DEMPSTER AND SONS' STOKING MACHINERY AND SLIDING RETORT-LID.

Among the charging and drawing machinery of novel type shown at the Earl's Court Exhibition in November and December last, the gas profession evinced a very appreciative interest in the forms put on view by Messrs. Robert Dempster and Sons, Limited, of Elland, and which represented the inventions of Mr. H. J. Toogood and Mr. F. W. Ordish in these particular lines. These exhibits of the machinery, in fact, were the first finished examples of the actual designs. Simultaneously with their first public appearance, we gave a description, with drawings and other illustrations, of the principles of construction and working (see "JOURNAL" for Nov. 22 last, pp. 608-612); and therefore it will now be of interest to readers to follow the machines up to what is to be their primary application to practical working.

The Falkirk Corporation Gas-Works are to be the scene of the introduction of the machinery into actual operation; and this has come about through the advice of the Gas Engineer (Mr. William M'Crae). The progressive march of affairs in the gas business of Falkirk has not only necessitated this step, but it has devolved upon Mr. M'Crae to recommend the building of a complete new gas-works. It is in the new retort-house, to contain twelve beds of eight through retorts, 20 feet long, that we have an immediate interest. This house is to be made as perfect as is considered possible in economical efficiency by the installation of a complete coal and coke handling plant. The bench has been specially designed to work in conjunction with the new method of charging and discharging horizontal retorts, inasmuch as the furnaces are placed on one side of the bench only, and opposite to the stoking machinery. The furnaces are of Robert Dempster and Sons' patent regenerative producer type; the firm having been successful in obtaining the contract complete with retort mountings,

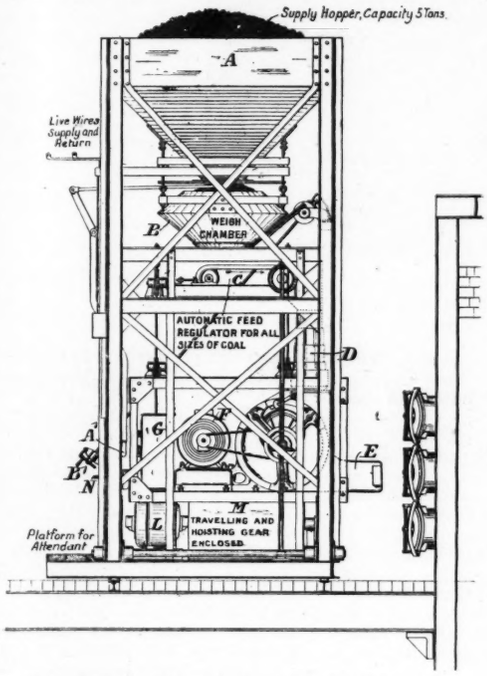


FIG. 1.—SIDE ELEVATION OF TOOGOOD'S POSITIVE RETORT CHARGING MACHINE.

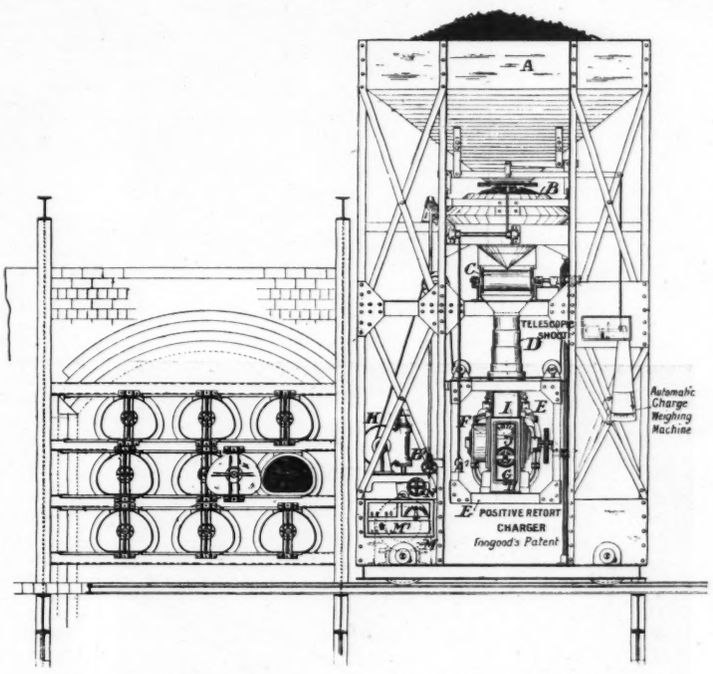


FIG. 2.—FRONT ELEVATION OF RETORT-BED, SHOWING APPLICATION OF THE NEW SELF-SEALING LID. (One lid shown open.)

FIG. 3.—BACK ELEVATION OF CHARGER AS ARRANGED FOR THE FALKIRK CORPORATION GAS-WORKS.

A. Supply hopper, 5 tons capacity. A1. Lever to open the outlet slide from hopper. B. Weigh chamber to weigh any charge varying from 5 to 8 cwt. B1. Handle to operate outlet slide from weigh chamber. C. Automatic feed regulator to proportion the supply to machine, irrespective of size or quality of coal. D. Telescopic shoot of large diameter to allow all sizes of coal to pass with equal freedom. E. Toogood's patent positive retort charger for all sizes of coal. F. Motor 6 B.H.P. to drive the charger and feed regulator. G. Casing containing the resistances, switch starter, overload release, no load release, speed regulator and interlocking gear to prevent damage, and to permit of the inexperienced at once taking charge. H. Emergency switch only used when machine is standing idle for a lengthy period and to permit of overhauling the controller, &c. I. Starter with combined automatic releases and automatic interlocking gear. J. Speed regulator with 55 variations. K. Elevating and lowering gear driven by motor L. L. Reversing motor for traversing the machine and raising and lowering to the several tiers of retorts. M. Enclosed gearing for traversing the whole machine along the house at a maximum speed of 150 feet per minute and at a slow speed from retort to retort. M1. Reversing starter and resistances for Motor L. N. Handle to operate clutches so as to couple motor L to either hoisting or traversing gear.

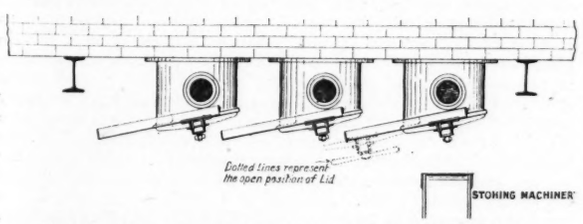


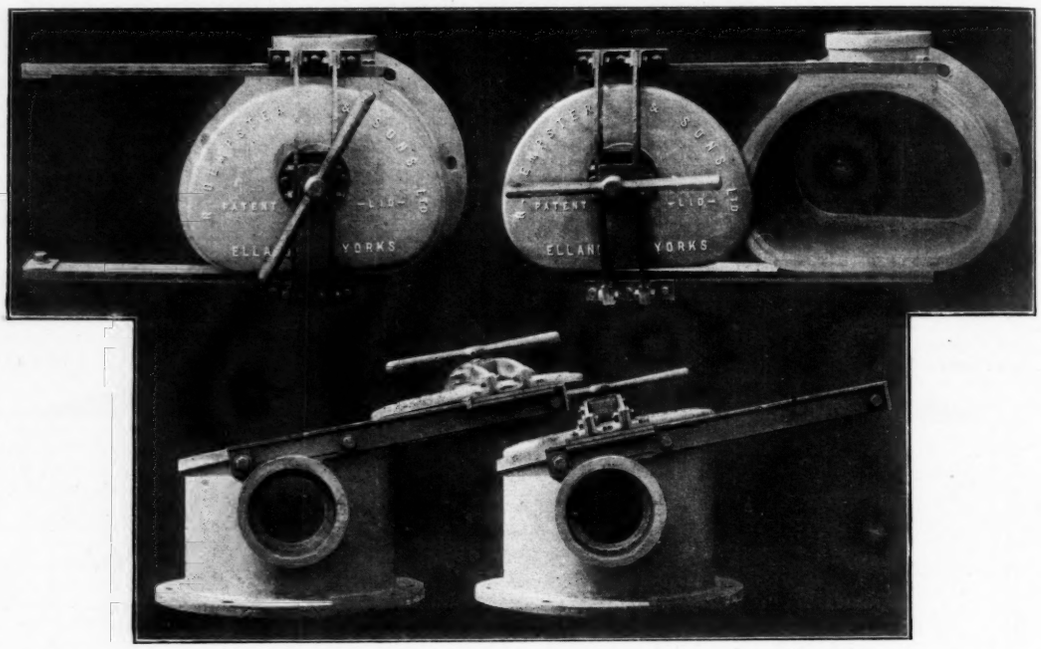
FIG. 4.—NEW SELF-SEALING LID, TOOGOOD'S PATENT.

together with the charging and discharging machines, excluding the conveyors. The contract is nearing its fulfilment.

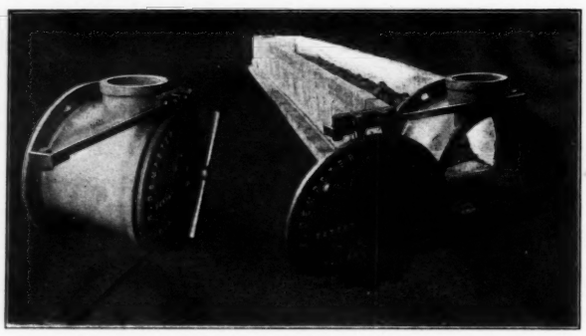
The drawing and charging machinery is, of course, the unique feature of the new house. In regard to the Toogood charging-machine, it may be useful to recall that it consists of blades moving at variable speeds. At the slowest speed, they gather the coal which is fed in at the periphery. The speed is then automatically accelerated in a gradual ratio until the delivery opening is reached, when the coal is hurled into the retort. The objects of the patentee have been: (1) To produce a machine which does not rely upon friction or upon centrifugal force, which, of course, varies with the different sizes and descriptions of coal. (2) To realize a machine absolutely positive in action; thus imparting to all coal, whether large or small, the required velocity, with consequently the ability to throw in one lump at the same velocity as a shovelful, thus ensuring perfectly level charging. (3) To furnish a machine which cannot be injuriously affected by the heat radiated from the retort-bench.

The charging and drawing machines which are going to Falkirk are illustrated here. The charging machine is arranged to run on rails, and is fitted with a supply-hopper, which, we are informed, will hold 5 tons of coal. Underneath the hopper is fitted Broadhead and Denison's patent weigh-chamber, which allows of the charge being automatically weighed and varied at will from 5 to 8 cwt. per through retort, immediately preceding the operation of charging. Underneath the weighing device is fitted an endless conveyor, driven by bevel gearing from the charging-machine, which ensures that the amount of coal fed in is always proportional to the speed of the machine. This device permits of a telescopic shoot of large diameter being provided, to allow all sizes of coal being passed through with equal freedom. The Falkirk machine has been designed to deal with coal up to $3\frac{3}{4}$ inches cube—viz., $6\frac{1}{8}$ inches across the corners.

Since the exhibition, Messrs. Dempster and Sons have been experimenting with the machine, and have now arrived at the type of motor, controller, &c., best suited to the conditions. They have fitted up the exhibition machine at their works, complete,



VIEWS OF THE TOOGOOD SELF SEALING RETORT LID.



with its overhead hopper, feed device, &c., in front of a built-up retort, 20 feet long. Into this, for demonstration purposes, coal is charged; and those engineers who have made inspection of the plant are, we understand, perfectly satisfied that, with all kinds of coal mixed in any proportions of various sizes up to the large size named above, an even distribution over the whole length and breadth of the retort can be obtained. It is also said that no coal is spilt in the process of charging; and very little draught is created when the coal is being projected. On these points, of course, any engineer is at liberty to satisfy himself.

It need hardly be explained to our readers that the machine can be arranged to be supplied with coal from fixed overhead hoppers of the continuous type, in which case, of course, the framework of the machine will be of much smaller dimensions; or the charger can be also arranged to run on overhead rails. The Falkirk machine is to be traversed longitudinally, and elevated and lowered to suit the different tiers of retorts, by means of an electric motor. The whole of the controlling arrangement is compact, within easy reach of the attendant, and the manipulation is simplicity itself—thus permitting an ordinary stoker to work the machine, and to bring it with certainty and precision to any retort in the house by motive power.

Regarding the Dempster and Ordish patent retort-discharging machine, we are enabled now to give a more complete account of it than there has been an opportunity of doing before. The ram consists of solid-drawn steel tubes, arranged to slide one within the other. Both the tubes are water-cooled (on the inside) continually, and also the small tube on the outside after each discharge. The tubes are extended, and returned by means of a unique arrangement of wire ropes, by running which the tubes advance and recede in arithmetical progression, which allows the small tube to have the maximum support in its neighbour until the coke is discharged. The object of the design is to couple the points of merit of a hydraulic ram with the facilities offered by the application of the arrangement of wire ropes. By the means adopted, the cooling effect of the water is retained, while the difficulty due to the pressure in keeping tight packings in the hot retort is entirely avoided. The tubes are only partially filled with water when extended; thus reducing the deflection of the tubes due to weight. The tubes are of ample strength to be self-supporting; thus keeping the head of ram from exerting pressure on the bottom of the hot retort.

The Falkirk discharging-machine is illustrated in figs. 5, 6, 7; and from these it will be seen that the machine has been considerably improved and simplified since it was shown at Earl's Court. Generally describing the construction, the discharging-ram is composed (as shown in detail in fig. 6) of two weldless steel tubes D E, 3 inches and 5 inches inside diameter by $\frac{1}{4}$ inch thick. The small tube D is telescoped into the larger one E, which is provided with carriages F for running in the channel steel guides G, forming part of the rising and falling frame. At the front end of the largest tube E, is fitted a packed gland, as well as jockey wheels (in a casing) for the rope C, which extends the smaller tube D, and traverses the tube E out from the channel steel framing G. The tail rope B is attached to the back end of the small tube, and then back over a jockey wheel in the water-box H; the other end being fixed at any convenient point on the main frame of the machine. The rope B is only for actuating the tube D on its backward stroke, and regulating its position when extending, as the operation of closing or withdrawing the ram from the retorts after discharging is accomplished by the ropes in duplicate A A1, which are on the outside of the ram, and are never nearer than 7 feet to the retort mouthpieces. The ropes A A1 are fixed at one end to one of the carriages F, over the jockey wheels on the channel frame G, and then to the small winding-drums J J. With this arrangement of ropes, any rope can be renewed in a very short time, as the only rope that has to be threaded inside the tubes is that marked C; all the others being easily accessible without dismantling the machine. It may be urged by some engineers that the life of the ropes will be short, and that if the ropes break serious inconvenience would be caused. The makers' answer to this is that the ropes are $\frac{5}{16}$ inch diameter, made of best pliable galvanized steel wire, and are about five times stronger than is required for the safe working of the rams; and there appears to be no reason why the ropes should not work for many years without trouble or inconvenience. If, however, a rope should break or require attention or examination, it is, we understand, only the work of a few minutes to entirely renew the ropes; and the total cost of the whole of the ropes on the machine does not exceed £2 10s. Further, at a small extra cost, it can easily be arranged to have a complete set of tubes as a stand by, with a view of replacing any set of tubes that require attention—the work of changing the new set being an operation requiring only a short time.

At the back end of the tube E, an open water-box H is fixed, into which such an amount of water is run as to entirely fill the tubes when closed—thus continually cooling the small tube D inside and out, and the tube E on the inside, and giving a free exit for any steam generated. With this arrangement of water cooling, no water pressure is put on to the packed gland.

This, we think, generally completes the description of the ram proper, with the exception of the head, which is made in the form of a scoop, is easily renewable, and will be automatically sprayed from the tank on the machine after each operation of discharging a retort. The main frame of the machine is built up of four vertical 8 in. by 3 in. steel channels, braced and tied together by

A & A1. Ropes to tube carriages. B. Tail rope. C. Ram-extending rope. D. Small tube. E. Large tube. F. Carriages. G. Frame. H. Water-box. J J. Small winding-drum. K. Traversing controller. L. Rising and falling frame. M. Ram-motor. N. Ram-controller. O. Clutch lever.

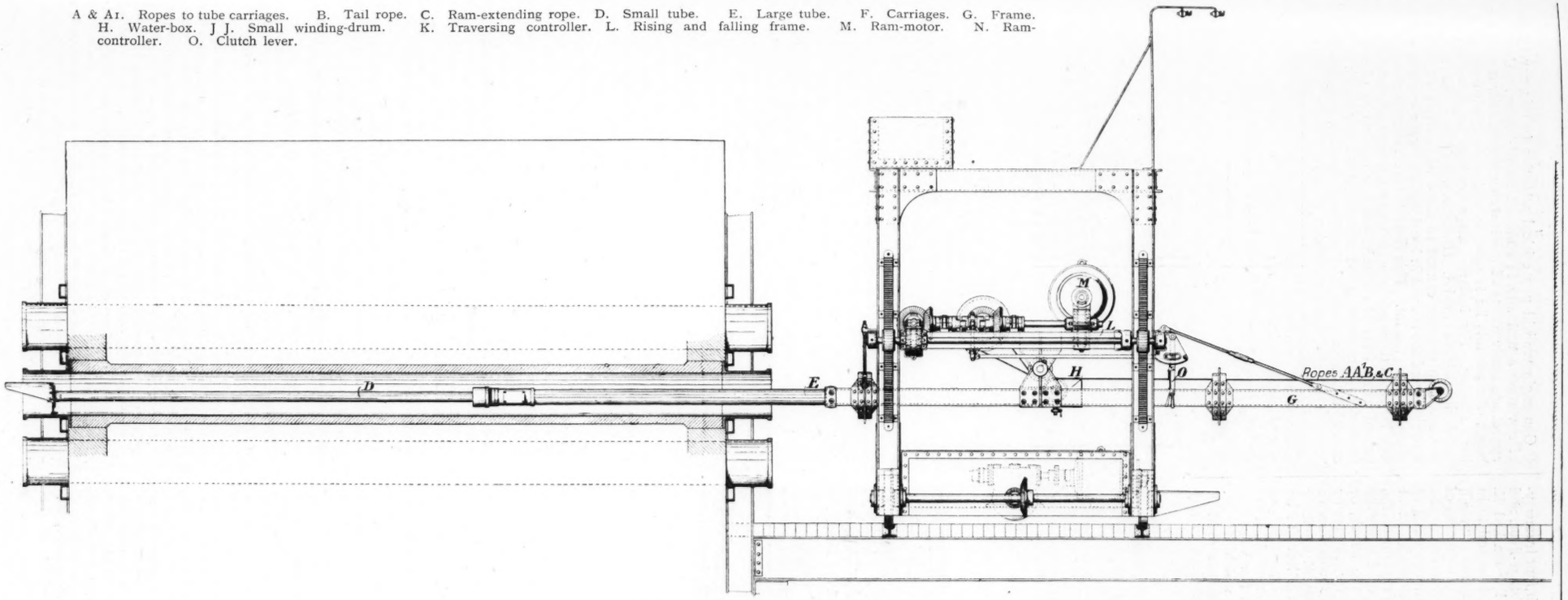


FIG. 5.—THE DISCHARGER WITH RAM EXTENDED.

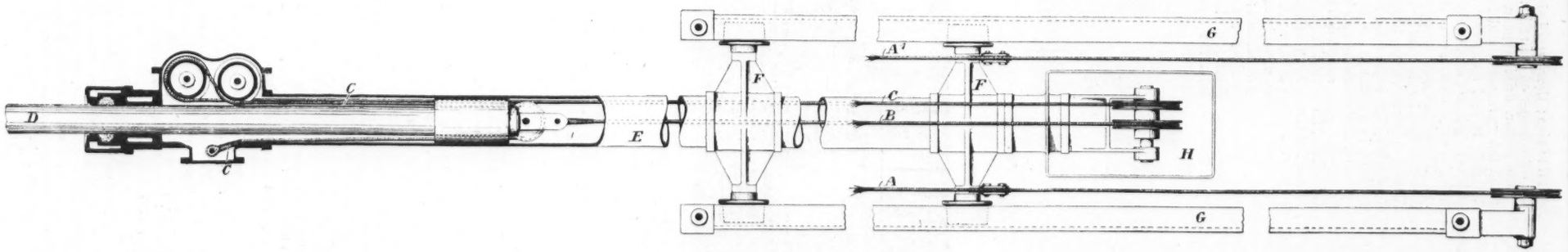


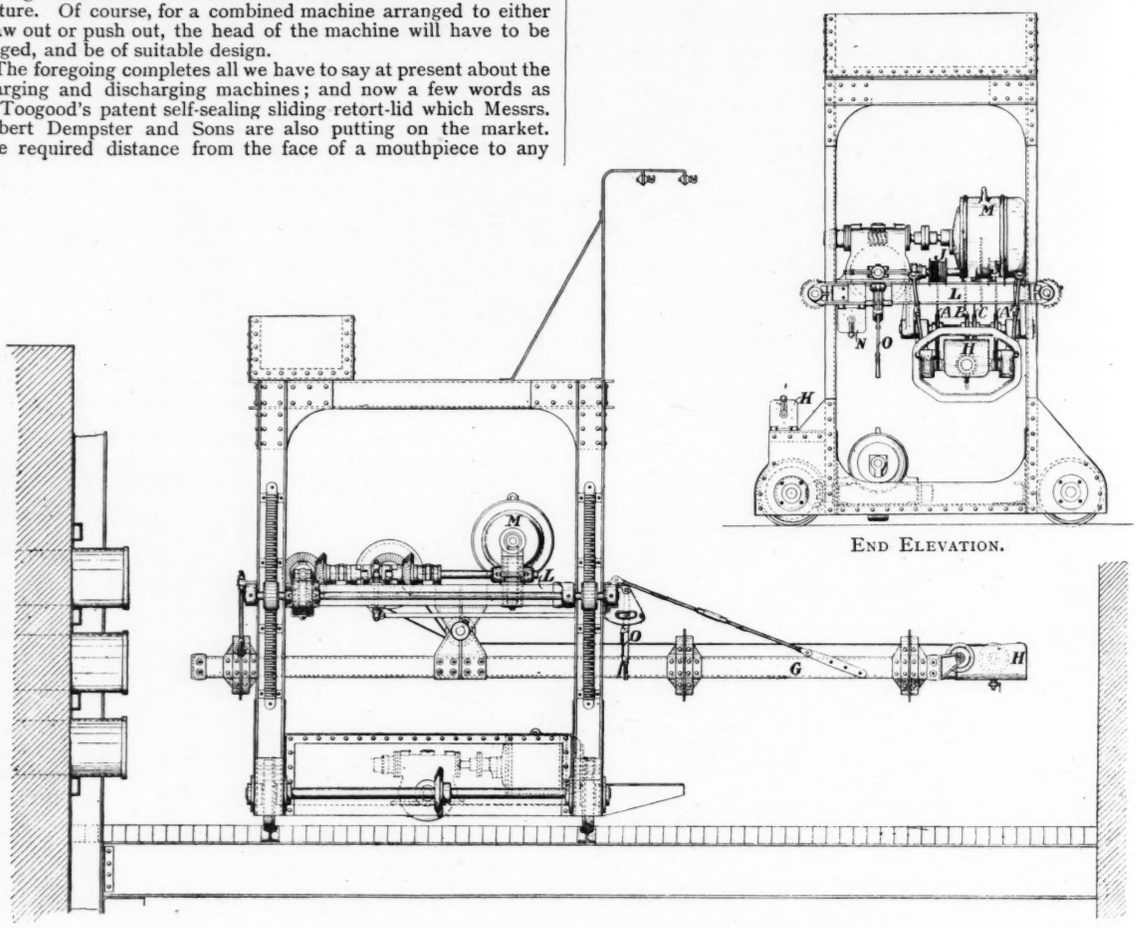
FIG. 6.—DETAILS OF RAM AND FRAME.

steel plate and angles; this frame being fitted with four tramway-type wheels for running on the rails fixed on the stage-floor, and complete with motor, driving gear, and controller marked K. The rising and falling frame L and ram-frame G is complete in tself, with motor M and controller N for working the ram, and raising and lowering it to the required tier of retorts by means of the rack-and-pinion gear on each of the four uprights forming the main frame. The clutch gear for operating the ram or raising or lowering it is operated by the one lever O. As the producers at Falkirk are only on one side of the bench (as already explained), the discharging-machine has been designed for only pushing out the coke; but where furnaces are on both sides of the bench, or for single retorts, the machine can be designed for pushing or pulling as desired. This the makers claim to be a distinctive feature. Of course, for a combined machine arranged to either draw out or push out, the head of the machine will have to be hinged, and be of suitable design.

The foregoing completes all we have to say at present about the charging and discharging machines; and now a few words as to Toogood's patent self-sealing sliding retort-lid which Messrs. Robert Dempster and Sons are also putting on the market. The required distance from the face of a mouthpiece to any type of charging or discharging machine, to allow of the opening and closing of the present type of self-sealing lid with the machines in position opposite the retort, is about 40 inches. Generally, they cannot be kept so far away from the benches; and consequently the practice is to open the lids before the discharging-machine is in position, and to keep them open until the charge is in and the charging-machine removed. It cannot be questioned that this method is productive of waste—both of heat and gas. It is in order to enable the machines to be brought still nearer, to save room, and to permit of the lids being opened and closed with the machines in position, that the sliding lid here illustrated has been designed. The lid, together with its vertical cross-bar, slides bodily, and is tightened by a screw when in position; thus being self-adjusting. One view shows the lid closed, the other shows it opened; and the plane of the lid, being inclined to the centre line of the retort, ensures each lid clearing the adjoining one. The lid is extremely simple in construction, and easily manipulated. By its adoption, the distance from the mouthpiece to the machine can be reduced from 40 inches to 10 inches. The lid can thus, under any circumstances, be opened and closed with any type of charging or discharging machine in position opposite the retort; thus saving the heat and gas which at present are wasted, and reducing the amount of smoke and flame which usually escapes into the retort-house. The saving to be effected by the application of this lid is calculated by the makers to repay its cost. It further obviates the necessity of a shoot leading to the retort when charging wet slack coal with a projecting machine. The lid will in practice be fitted with a tar-fender, &c. Besides these points, it is claimed that the lid retains all the merits, including sliding surfaces, of previous designs.

Gas engineers will pay critical attention to this novel means of obviating a difficulty in confined retort-houses. Users will appreciate many points of merit which incidentally occur to the mind, whether this lid is used in conjunction with machine or hand stoking. For instance, attention may be directed to the self-sealing edges of the lid. Hitherto, a constant source of leakage has been the damage caused to these self-sealing edges by the swinging to of the lid, and in hand stoking by the use made of the shovel to open the lid. This difficulty is entirely overcome in the new lid, since these surfaces are protected from all harm by being turned away from the stoker, whether opened or closed; and further they are never called upon to stand any shock or jar in closing the door, which fact in itself should greatly prolong its working life. Another feature is the vertical crossbar, which is much shorter, and therefore stiffer and stronger; also the tar falling from the tier above is not caught by the crossbar, as hitherto, and allowed to besmear itself over the working parts. Instead, it can fall clear away to the floor except for the width of the bar, which the makers intend making of a box-section, so as to keep all tar from interfering with the screw, &c.

The slides upon which the crossbar works cannot be interfered with by an accumulation of tar, since, by an ingenious arrangement, the crossbar clears itself each time it is opened.



End Elevation.

Fig. 7.—The Discharger with Ram Closed.

[For Index to Lettering, see p. 431.]

Midland Association of Gas Managers.

The members are visiting the President (Mr. Thomas Berridge) at Leamington next Thursday; and confidence accompanies the prediction that there will be a considerable turn-out on the occasion. The beauties—natural and historical—of Leamington and the district have an irresistible charm and attraction not a whit the less for gas engineers and managers than other people. There will in the early morning—11.15—be a short meeting at the Crown Hotel, at which, in addition to a little ordinary business, a paper appropriate to the "spring-cleaning" season will be read by Mr. Henry T. Fowler, of Derby. It is entitled "Notes on the Painting of Gasholders." Subsequently an inspection will be made of the gas-works, which are under the President's charge. There will then be a drive, comprehending Warwick Castle, Guy's Cliffe, Kenilworth Castle, and Stoneleigh Abbey. "Luncheon" is timed for 3 p.m.; and to this invitation is kindly made by the Directors of the Gas Company.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Hundred and Forty-Third Quarterly Meeting of the Institution was held last Saturday, in the Council Chamber of the Leeds Town Hall, by the kind permission of the Lord Mayor, the Right Hon. Robert Armitage, J.P. The PRESIDENT (Mr. S. Meunier, of Stockport) occupied the chair; and there was an excellent attendance of members.

The HON. SECRETARY (Mr. H. Kendrick, of Stretford) read the minutes of the last meeting, which were duly confirmed. He also read the names of several gentlemen who had written expressing their regret at being unable to attend the meeting. Letters were also read from Mrs. Bromley and Mrs. Worsley, thanking the members for the votes of condolence and sympathy passed at the preceding meeting.

PROPOSED LECTURES.

The HON. SECRETARY said the Committee had had in hand the subject of the proposed lectures; but before taking it up as a body, they had endeavoured to see if the Council of the Institution of Gas Engineers could do anything. A letter had been received from the Secretary of the Institution (Mr. Walter T. Dunn), in which he thanked them for the suggestion. He said the Council considered the matter on the 28th of February, but had come to the conclusion that it was hardly possible to recommend the adoption of the suggestion.

PROPOSED ALTERATION OF RULES.

The PRESIDENT said it had been felt for some time past by the members of the Commercial Section that the presence of the class of gentlemen referred to in the proposed new rule would be materially useful, and would help them in their work. For this reason the Committee had considered the question, and had put forward that day suggested alterations of the rules to allow of such gentlemen being admitted as associate members. The first rule on the paper was practically the old one over again. It was proposed that the qualification for membership of the Institution should be: "Members: Resident engineers or managers of gas-works, and gas engineers solely employed as consulting engineers, and not engaged as agents for any trading or manufacturing firm." Managers of gas-works were the engineers; and this was the way the rule had always been construed. To bring in the class of people who they thought would be useful to the industry, and who would assist in pushing forward its best interests, the Committee thought that a class of associate members might be formed. Therefore, the following rule was suggested for their adoption: "Associate Members: Commercial superintendents or general managers of gas undertakings solely employed as such, assistant engineers or assistant managers of gas-works making 500 millions or more per annum." The other alterations to the rules were merely consequential on the adoption of the two first. In his opinion, the assistance of the gentlemen referred to was required. At meetings of the Commercial Section, a great deal of benefit had been derived from their knowledge, experience, and advice; and he certainly thought it would be to the best interests of the gas industry to have the assistance of these gentlemen. If the wording of the suggested rule did not meet the views of the general body of the members, or if they thought that the way in which it had been framed would open the door to some persons engaged in other lines whom they did not want to admit, it was open to them to suggest any amendment. What he was concerned with was to have the principle admitted. If they did this, they could safeguard themselves as much as they liked.

Mr. R. G. SHADBOLT (Grantham) asked, with regard to the associate members' clause, Were they to take it or leave it as a whole?

The PRESIDENT said it should be taken as a whole, with such amendment as the meeting thought desirable.

Mr. SHADBOLT did not think the time opportune for admitting assistant engineers or assistant managers of gas-works of any size; and, further than this, he did not think the size of the works was any criterion of ability. In Lancashire and Yorkshire, they had not derived any benefit in their Commercial Section from assistant managers, though they had from general managers. He did not think the two classes should be associated in the manner suggested by the rule.

The HON. SECRETARY said the stipulation as to the size of the works with regard to assistant engineers and assistant managers was put in because—although the Committee generally accepted the principle—it was felt that unless there was the limit it would interfere with the working of the Junior Associations. It was not intended to take members away from those Associations. There were in connection with gas-works in the large towns a certain number of assistant managers who were certainly as well fitted to be members of their Institution as a very considerable number of their members who were managers of smaller gas-works. In the Manchester district there were at least seven or eight assistant managers or superintendents of large works who had approached either himself or others to know whether they could not become members of the Institution. The framing of the first suggested rule was such that it would only include the seniors, whose contention was that the Junior Associations were too junior for them. With regard to many of them, this was quite a valid reason; and they would much prefer to become members, if only associate members, of the Institution, than join the Junior Associations. They said if they were not allowed to become members of the Institution, they were practically debarred from becoming members of any Institution at all, and mixing with gas engineers generally.

Mr. SHADBOLT said that what Mr. Kendrick had just stated did not affect his argument in the slightest. He thought the Committee had hitherto put a fairly liberal interpretation on the term "manager;" and it would meet the case if they continued to do so. If they were to open their doors to assistants, there was no knowing how many assistants a chief might have. He thought the suggested rule was wrong in principle, and that the assistants ought not to be coupled with the commercial side.

The HON. SECRETARY said Mr. Naylor's assistant had first mentioned the matter to him.

Mr. J. W. MORRISON (Sheffield), as a member of the Committee, but not having received due notice of the meeting at which the alteration was made, said his opinion on the matter was somewhat adverse to the recommendations of the Committee. He thought if they started by admitting commercial superintendents they would bring about trouble such as the Institution had recently experienced. He should suggest that they started with the words "General managers of gas undertakings;" they being the gentlemen who generally dealt with the whole of the commercial questions. He did not agree with Mr. Shadbolt that assistant engineers of gas-works of a certain magnitude should be omitted. He had occupied the position of Superintendent of one of the largest gas-works in the country, and had tried ineffectually to get into the Midland Association. They saw some men occupying ridiculous positions who were members of the Manchester Institution, whereas many who held responsible positions were debarred from having anything to do with them. He thought that those who had paid for their experience should have the opportunity of becoming associate members. In regard to the 500 million limit, there were many towns where there were two or three gas-works, and they might get in two or three men from a town of 600 million feet capacity.

Mr. J. C. BELTON (Chester) quite agreed with Mr. Morrison, and fully sympathized with the feeling he had expressed as to his former position. There were many in the profession who had had the same experience. He thought the whole case would be met if the word "commercial" were eliminated, and the words from "as such." The question of assistant engineers or assistant managers was a very difficult one indeed. It would lead to endless complications and misunderstandings. If the rule were confined to superintendents of works under responsible managers or chief engineers, it would cover the case of which Mr. Morrison had spoken, and it would avoid the difficulty he had hinted at. By leaving in the general managers, they would include all such gentlemen as they wished to see on the commercial side, such as Mr. Andrew, of Oldham. In his opinion, superintendents of works and general managers of gas undertakings included all those whom they desired to see in the Institution.

The PRESIDENT said the wording of the rule was open to revision. As long as the principle was admitted that commercial general managers of gas undertakings should be eligible as associate members, he did not mind how it was worded. As Mr. Shadbolt had put it, these were the gentlemen whose assistance they wanted; and it was for their benefit that the alteration of the rule was proposed. When the matter was debated in Committee, it was felt that an injustice might be done to the class of men mentioned by Mr. Morrison; and it was to avoid this that they were included in the rule. Personally, he was in accord with Mr. Morrison. He had been a superintendent of works, having nothing to do with the commercial side, but simply had to carry on the works; yet he could not be a member of the Midland Association. There were engineers in charge of small works who were included; yet their experience was not half so varied or so valuable to the Association as his would have been. The main object of the suggested rule was to strengthen the Commercial Sections.

Mr. W. W. HUTCHINSON (Barnsley) felt very strongly that such a drastic change in the constitution of the Institution required more care and thought than could be bestowed upon it in the time at their disposal. He thought it was a fit subject to be referred back for further consideration. In order to do justice to the question, they would require to take up the whole of the afternoon. They had hitherto occupied the premier position in this matter of the Gas Associations of the country, and they should be very careful when making alterations of this sort. He did not wish to say that the Committee had not taken the matter fully into their consideration, and threshed it out to their own satisfaction; but the general body of the members had only had seven days' notice of the suggested alterations, and had not had sufficient time to consider them.

The PRESIDENT asked if the members admitted the principle.

Mr. HUTCHINSON said he did not think they did.

Mr. S. S. MELLOR (Northwich) said the suggested alterations were very drastic in their character, and, as an old member, he strongly objected to them. He was prepared to move, as an

amendment—"That the consideration of the alteration of the rules be left over to the next ordinary meeting."

Mr. H. HAWKINS (Todmorden) seconded the amendment, and it was carried.

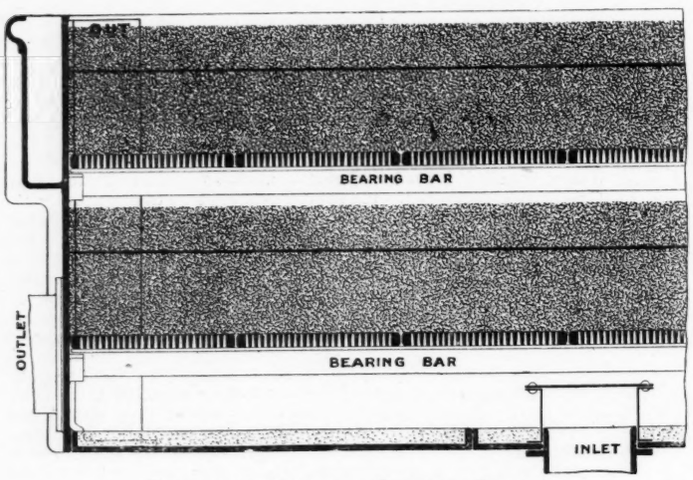
Mr. J. C. BELTON (Chester) then read a paper on

RECENT DEVELOPMENTS OF PURIFYING PLANT: SOME FURTHER NOTES ON JÄGER GRIDS.

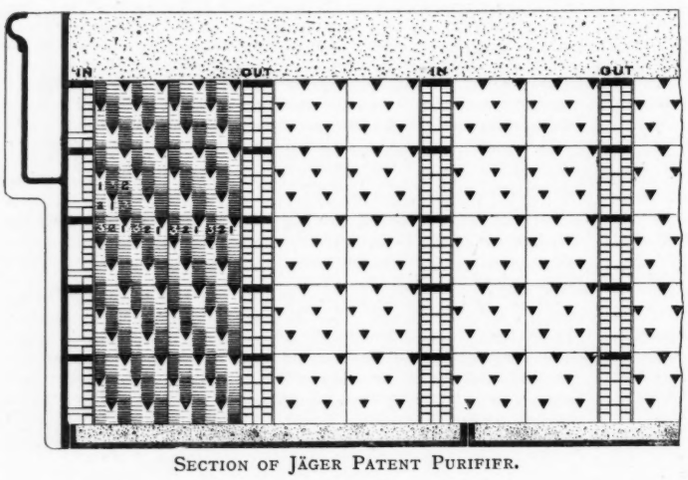
It is first of all necessary to give you the reason for my appearing before you to-day with what must be to some extent a repetition of matter that has already appeared in an article which I contributed to the "JOURNAL OF GAS LIGHTING" in February last. That article has been the subject of so many inquiries from gas engineers who wished for further particulars, that when our Secretary invited me to bring a paper to this meeting—having no other subject of immediate interest in hand—I rashly mentioned "Jägers" as a possibly acceptable theme, and was immediately "booked."

The article alluded to was confined chiefly to a statement of the working results obtained during the first six months' use of Jäger grids at the Chester Gas-Works, and nothing was said as to the method of adapting existing purifiers to the new system, or in description of the system itself. Messrs. S. Cutler and Sons have very kindly come to my assistance on the present occasion by lending their large model of a Jäger purifier; and it can be inspected at the close of the meeting. The drawings hung up before you show how the ordinary purifiers may be altered to suit the new conditions of working.

The essential features of the Jäger system of filling purifiers are the special grids and the horizontal travel of the gas. You may have a purifier filled with similar grids; but if the old vertical travel of the gas is retained, it is impossible to obtain the results achieved by the Jäger system. I suppose all, or nearly all, the purifiers in use in this country were constructed on the usual plan of introducing the gas through the bottom of the purifying vessel and causing it to pass upwards through one, two, or more layers or trays of purifying material, into the cover, where it is collected to one or perhaps two outlet pipes, whose open end is just above the level of the material in the box. The superficial area of a purifier so arranged represents the area of contact, or contact-surface exposed to the gas; and taking this as the divisor and the make of gas per second as the dividend, we get at the speed of the gas through the purifying material. Newbigging's rule for determining the proper area of purifiers results in a speed of 0·019 foot per second, and may be accepted as a standard for ordinary work, though greater economy in working might be obtained by using the constant 0·8, instead of 0·6, in determining the area.



SECTION OF PURIFIERS—ORDINARY SYSTEM.



SECTION OF JÄGER PATENT PURIFIER.

Now, it does not matter what depth of material you have in a purifier of the ordinary type, the speed of the gas will always be the same—that is, it will always bear the same ratio to the superficial area of the purifier. But in two purifiers of the same area, one containing two grids of material each of 1 foot in depth, and the other containing two grids each 2 feet in depth, while the speed of the gas is the same in both, the latter, having double the mass of material, would run twice as long as the former; but the resistance or back-pressure would be more than double the resistance in the shallower material. This was the difficulty I had always met with in attempting to obtain a higher duty from my purifiers by increasing the quantity of material through which the gas must pass. It was all very well in summer to increase the depth of oxide on the grids. The make being then at the minimum, it was possible to fill a purifier to its greatest capacity without the resistance being sufficient to overcome the water-seal. But as soon as the approach of winter made it necessary to put more retorts in action, the depth of the material in the purifiers must be decreased, or blowing would soon announce the presence of excessive pressure.

I could not find any means of increasing the contact area without enlarging the purifiers, or of avoiding the increased resistance obtained by increasing the depth of the material. What I wanted was a method by which the contact surface and purifying mass could be simultaneously increased, so as to obtain a slower

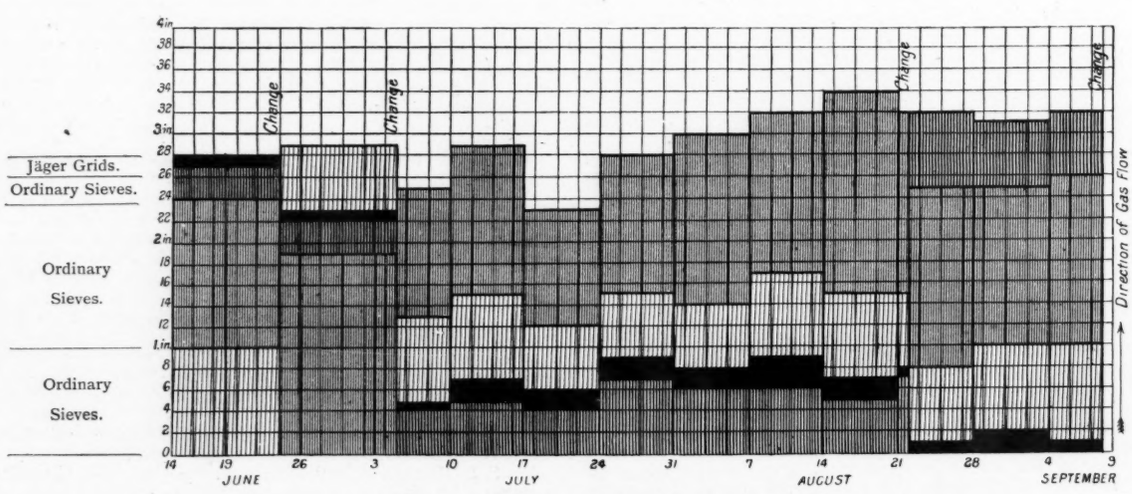
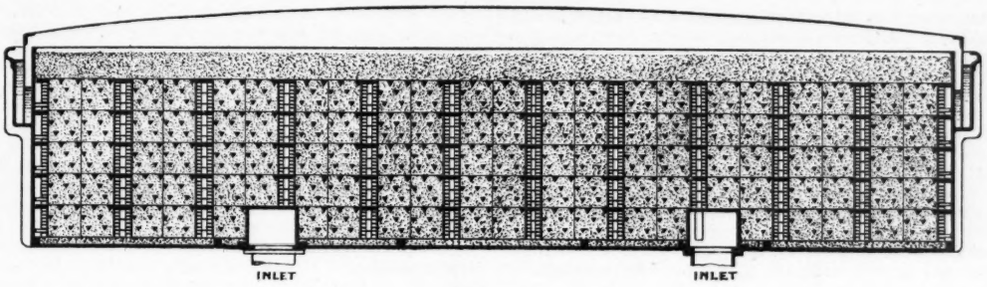
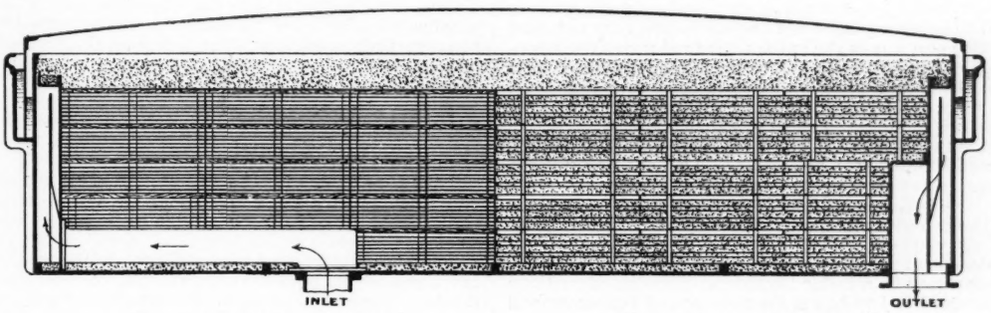


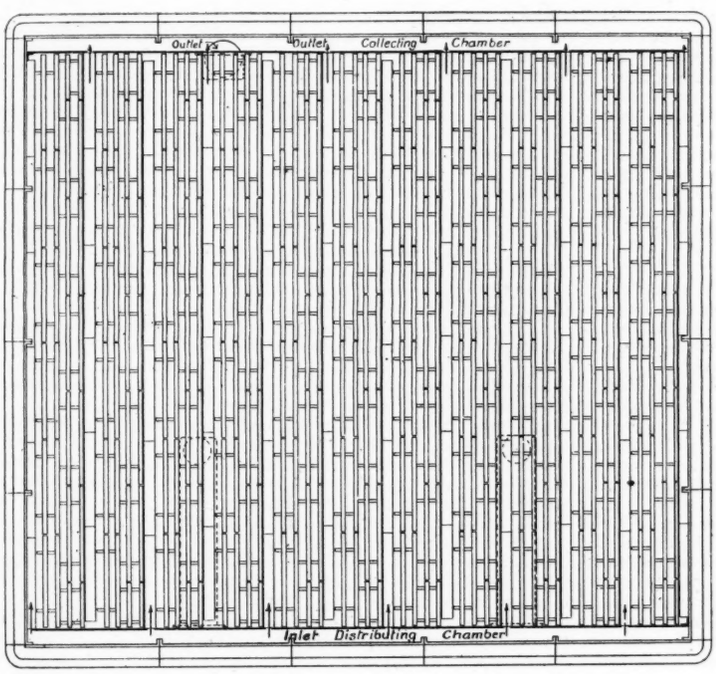
DIAGRAM OF DIFFERENTIAL PRESSURE.



SECTION.



SECTION SHOWING CONDUITS. SECTION SHOWING GRIDS.



PLAN.

speed of travel through the material and a corresponding decrease of resistance and extension of purifying efficiency. It was given to our German friends to discover the solution of this problem, and to demonstrate that it is only possible of attainment by altering the direction of the gas-travel from the vertical to the horizontal. This is the basis of the Jäger system; and the thing is so simple, now it is demonstrated, that one naturally asks, "Why didn't we think of it before?" By dividing the mass of purifying material into vertical sections, by the insertion of alternate inlet and outlet conduits, it is possible to put from 20 to 80 per cent. more material in a purifier of any given superficial area; the vertical subdivision of the mass of material and the volume of gas gives a very large increase of contact-surface with a corresponding simultaneous decrease in speed of travel and back-pressure. By these means, the run or life of a purifier is greatly extended; and the labour of emptying and refilling a Jäger purifier being no more than that required by the older system, there is an economy corresponding to the reduction in the number of changes taking place in any given period, less the increase in the quantity of material handled.

I have here a drawing of a section of our ordinary purifiers, showing the position of the inlet and outlet connections and the method of filling the box. The broad line through the mass of material shows the difference in depth of the layers for the summer and winter work. The area of the box is 24 ft. by 22 ft., or 524 superficial feet, deducting the standards. This is the area of the contact-surface; and it is obvious that no alteration in the depth of material on the grids will affect the speed at which a given make of gas must pass through the box. The mass of oxide contained works out to 1572 cubic feet effective in summer and 1048 cubic feet in winter; so that while the speed of travel increased with the make, the time-contact and mass-contact decreased, and the run of the purifier was shortened much more than would have been the case if the increased volume of gas had the same mass of material to pass through as in summer.

The next drawing shows the same purifier fitted with Jäger grids. There are five layers of grids, which, with the top cover, give a depth of 5 feet of purifying material. The material and grids, divided by the inlet and outlet conduits, are in eleven columns or walls, each 20 ft. 10 in. in length by 4 ft. 2 in. in depth. Each stream of gas represented by the inlet conduits is in contact with, and passes through, two of these walls. The contact-surface is thus increased from 524 superficial feet to 955 superficial feet—a difference of 82 per cent.—giving, with the maximum make of gas, a reduced speed of travel equivalent to 43½ per cent., that is, a speed of 0·013 foot per second instead of 0·023 foot per second in the ordinary purifiers. At the same time, the effective purifying mass is increased from 1048 cubic feet to 1598 cubic feet, or 52½ per cent., and, allowing for the partial efficiency of the covering layer, 80 per cent.

It is self-evident that a mass of oxide 5 feet in depth, unbroken by any intermediate supports, must have a greater density at the bottom than at the top, and this would tend to cause the gas to travel by the line of least resistance and rush through the upper layers of material, leaving the denser lower layers only partly sulphided. But here the utility of the special form of grid known as the Jäger appears. I expect most of you are already familiar with the advertised description of it; so I will only call your attention to the portion of the diagram which is shaded to show the effect of the Jäger bars in preserving equality of density throughout the column or wall of material. Each layer of grids is separately filled with oxide, which is shovelled in and levelled off before the next layer is placed in the purifier. The oxide does not become consolidated, because the rows of bars are so arranged as to break up the mass into a series of vertical sections, which never exceed 10 inches in depth; and every portion of the stream of gas, having to pass through six of these sections, has the same density of material to encounter. Consequently, the resistance is uniform over the whole area of contact-surface, and the sulphiding of the mass is equal throughout.

Until I had seen a Jäger purifier emptied, I was rather doubtful whether these conditions would be realized, or it would be found that some sections of material were more dense than others, and the sulphiding of the mass consequently irregular. But after having seen nine changes of purifiers, I do not hesitate to say that the conditions are perfectly fulfilled—in every case we have found that the grids were thoroughly filled and the sulphiding of the mass was perfectly regular. The support afforded to the material by the grid-bars is apparent upon lifting the grids, when three-fifths of the material remains in the grid and is lifted with it from the purifier and shaken out into barrows for removal to the revivifying floor. The diagram on p. 434 shows the recorded back-pressure thrown by the Jäger purifier compared with that thrown by the ordinary purifiers. The average for the Jäger is about 2-10ths.

The adaptation of the old purifiers to the new system is not a difficult matter. The standards supporting the T-iron bearers are taken out and the bolt holes in the bottom of the purifier filled up. The necessary inlet and outlet chambers are obtained by constructing curtains of steel plates attached to the two opposite sides of the purifier by channel irons. Each of these curtains has 5½ vertical slots extending the full depth and 1½ inches wide. The slots are about 4 feet apart, and arranged to be opposite the ends of alternate conduits; so that the stream of gas passing into an inlet conduit must travel right and left through a grid section to reach an outlet conduit. The inlet pipes are connected to the inlet chamber by cast-iron hoods; and the old rectangular outlet pipe being removed, the outlet at the bottom of the purifier is connected to the outlet chamber by a shorter cast-iron box, and still acts as the main outlet. These were all the structural alterations necessary, and only took a few days to carry out.

The question may be asked, "Do the results obtained continue to be satisfactory?" I will state the figures; and I think you will agree with me that they do. The average run during the winter season was formerly only 19 million cubic feet. The average run of the Jäger purifiers during the winter just passed was 29,024,000 cubic feet—an increase of 52·75 per cent.; and this, it must be borne in mind, with only two out of the set of four purifiers fitted with Jäger grids. But owing to the great reduction of back pressure in these two, I have been able to work all through the winter with full summer depth of material in the two ordinary boxes of the set. The average run of these also has been consequently increased to 24,384,000 cubic feet, an increase of 28·33 per cent. The average for the whole set this winter has been 27,035,000 cubic feet, as against 19,000,000 formerly, or an all-round increase of 42·28 per cent. due to the assistance of the two Jäger boxes; and there have been 18 changes of purifiers, as compared with 33 in the same period of the previous season.

Discussion.

Mr. R. G. Shadbolt (Grantham) said he scarcely knew which to admire most, the very thorough and interesting manner in which the reader of the paper had gone into the details, and explained the construction of the apparatus, or, on the other hand, his courage in bringing forward what might by some be misconstrued as an advertising paper. The members of the Institution were more greatly benefited by having the drawings and models placed before them; and it was not always well to have the names of the makers suppressed where the apparatus was one that was likely to be useful. He (Mr. Shadbolt) had been victimized a little in this respect in the past. Mr Belton threw out a direct challenge when he said they might have a purifier filled with similar grids to those adopted by the Jäger system; but if the old vertical travel of the gas was retained, it would be impossible to obtain the results achieved by this system. If he were a maker of any other system, he should look into the matter to see if this statement could not be controverted. The whole arrangement of the apparatus as described by Mr. Belton was exceedingly ingenious and simple; and they could not help feeling a little bit jealous of their German friends, who seemed to have the knack of getting over stiles which others had been stumbling at for many years. Mr. Belton remarked that what was wanted was some method by which the contact-surface and the purifying mass could be increased simultaneously, so as to obtain a slower speed of travel through the material, and a corresponding decrease of resistance and extension of purifying efficiency; and he went on to say that the Germans had demonstrated that it was only possible of attainment by altering the direction of the gas travel from the vertical to the horizontal. The question of changing the flow of the gas from the vertical to the horizontal appeared to be the *crux* of the matter; and it was worthy of consideration as to whether this was the real factor in the case. It might be said that the bars were also a great factor. He could not help questioning whether, when the purifying material had been so lightened and held up by the arrangement described, equal advantages could not be obtained by allowing the gas to flow through vertically, instead of splitting it up into horizontal streams. He took it that the thickness of the material was about 1·63 feet, or a little over 18 inches.

Mr. Belton: 21 inches.

Mr. Shadbolt said, in his opinion, the inlet area was not the only thing to be considered. If they sought to increase the surface contact for the incoming streams of gas, and cared to pursue this to an extreme, so many walls would be constructed that there would be practically no thickness of material left. In other words, by increasing the amount of contact with the incoming gas, the bulk of material through which it had to pass would be decreased. Therefore he should like to know whether any limits had been determined upon. It appeared to him that the lightening of the material was a more important factor than altering the direction of the flow of gas. He thought it would be better to go on the lines of lightening the material, but still retaining the vertical flow. Where there was a nest of boxes, it was very difficult to adopt this system, particularly if the safety valve were in the middle of the nest. If the bulk of the material was saturable with the gas as the grids were arranged, would not a larger bulk enable them to increase the efficiency of the purifiers just as much as the slight advantage said to be obtained from the horizontal flow? If they took a solid mass of oxide—say, 524 square feet by 4 ft. 6 in. deep—they would get a bulk of 2358 cubic feet, as against the 1598 cubic feet referred to in the paper, which would be a decided gain if they could do without back-pressure. To his mind, in the system described, the bulk of material was sacrificed to some extent in obtaining surface contact. It would be interesting to know what improved working would be shown by such a method as he had suggested, as he thought if anything approaching the same result could be obtained without all this splitting up, it would be a great advantage. He had been led to say what he had done from the experience of a friend of his who had been working on the lines he had suggested during the past winter. The boxes with which he had been working were 25 feet square. One of them during the early part of the winter by the old system purified 13 million feet of gas. By the new system, still passing in the gas vertically, he had purified 30 million feet, or an increase of 130 per cent.; while with another box the increase had been from 12 to 23 millions, or an increase of 90 per cent., and the back-pressure shown had decreased by about two-thirds. These seemed to be remarkable figures; and if they could only be substantiated, he thought—notwithstanding all the ingenuity of their German friends, to whom they were much indebted—they could arrive at similar results by much more simple methods.

Mr. S. R. Ogden (Blackburn) said he had been able to get practically the same results as Mr. Belton by dividing the gas into streams. He did not think there was much in the question of horizontal or vertical working. He had dropped the top bearer, and had taken up the inlet pipe to the centre of the box; thereby obtaining a means of dividing the stream of gas so that half went up and half down. By his method, he had been able to put in 100 per cent. more oxide than the box would formerly hold. During last winter, he had worked through three boxes 35 feet by 25 feet with only ¾ inch back-pressure. He had also altered the lime purification box by putting in 120 per cent. more lime; and he had been able to work these boxes last winter without bye-passing the gas once. He had effected a saving of something like 50 per cent. on purification charges. It always appeared to him that if their boxes were small their revivification would also be a trifling matter. Dealing with boxes filled with grids such as had been described, a large amount of space would be required to clean them; and if their space was limited, they would be a nuisance rather than an advantage. His experience was that he could get good results with simpler apparatus.

Mr. H. Hawkins (Todmorden) asked whether it was practicable to get the oxide or lime in the purifying-box described in the paper at an even thickness, in the same way as was done with the ordinary horizontal purifiers. How could they guarantee that the oxide or the lime, as the case might be, would be equally distributed over the grids when it was filled in at the top of the box after the sieves were put in? In his opinion, this would be an utter impossibility. His experience was that the gas would go through the easiest places; and the consequence would be that half of the box would be perfectly useless.

Mr. G. S. Sayner (Harrogate) said he had looked into the matter when the system was first introduced, and was so satisfied of its utility that he arranged to have two boxes fitted with it. The principle of turning the gas in in several streams in a horizontal direction, and not having to encounter a certain amount of back-pressure, at once settled what the result would be from a chemical point of view. With regard to the question of filling, the boxes were not filled from the top, but in layers, which insured the oxide being equally distributed among the bars from the bottom upwards. He should like to ask Mr. Belton how many changes of boxes he had to make before the oxide was fully spent, and also if he could state the actual increase of weight in that particular size compared with the ordinary method. He should also be glad to know how many boxes Mr. Belton had in all.

Mr. J. W. Morrison (Sheffield) inquired as to Mr. Belton's experience of the probable life of the grids. They seemed to be rather lightly put together; and it occurred to him that if the ordinary workman had to deal with them they might be knocked about. Moreover, it was known that there was an excessive amount of heat generated, which might cause the boards to warp, which would be detrimental to the working. He also wished to have particulars as to the cost of changing (say) per million or per thousand, as compared with the old system, which, of course, would be a most important factor. Mr. Shadbolt had said something about not liking to be indebted to the Germans; but it must be admitted that the many trials which had been initiated in other directions had been set on foot by reason of what the Jäger system showed them.

Mr. W. W. HUTCHINSON (Barnsley) asked what the cubical content of the wood was, as compared with the old grids.

Mr. J. H. BREARLEY (Longwood) said Mr. Shadbolt had anticipated two or three questions that he had intended to raise; but there was one point which had not as yet received much attention. This was with regard to the surface contact. What was surface contact, and when did it take place? He took it that if the gas was made to come in contact with the particles of oxide in a purifier, without being subjected to back-pressure, surface contact had taken place right from the moment that the gas came into the purifier till it left it. Mr. Belton said his difficulty was that he got back-pressure when the material was 2 feet in depth. If the depth of the material could be maintained, at the same time overcoming the back-pressure by some contrivance, it would be far better than having a travel of 1 ft. 9 in. If the gas only passed through 1 ft. 9 in. of oxide, he did not see why it should not be possible to have the purifiers practically filled with oxide, without any contact surface, so long as there was a device to prevent back-pressure.

Mr. J. H. BUCKLEY (Formby) asked Mr. Belton if the oxide became thoroughly sulphided between the bars. If so, it would take a zig-zag course, and not a horizontal one. He should further like to know whether Mr. Belton had tested the purifiers at various stages for back-pressure.

Mr. BELTON said the back-pressure of all the purifiers was taken.

Mr. BUCKLEY: And in the various positions? It was very essential that they should know what the back-pressure was at the top layer of the purifier.

The HON. SECRETARY (Mr. H. Kendrick) said he was in the same position as Mr. Brearley; many of the points which he intended to raise having already been referred to. When he first went to Stretford, he found that it was the practice there to have one layer of oxide 4 feet thick in the boxes. Having been used to two or three layers in the other works where he had been, he was astounded, and expected to find an enormous amount of back-pressure; but, much to his surprise, he did not get it. He should like to know if any advantage was to be derived from the new system, beyond a little decrease in the back-pressure. With a 4 feet layer of oxide in a 20-feet box, it would work without giving more than 4 or 5 inches of back-pressure when passing 900,000 cubic feet a day; and it was only when they got up to a million cubic feet during the last winter that he had to put a second set in. He should like to have some particulars with regard to the cost of fitting up the new purifiers, and also as to the cost of changing, as compared with the old style.

The PRESIDENT said the subject had been very well dealt with in the discussion that had taken place, and several questions had been put for Mr. Belton to reply to. While listening to the discussion, he particularly noted two points. In the first place, Mr. Shadbolt raised the question whether the beneficial effect of this system was not largely due to the fact that the purifying material was considerably lightened as compared with the ordinary system in use; and, secondly, Mr. Ogden referred to the question of dividing the stream. One of his (the President's) earliest experiences was having to deal with the question of back-pressure in purifiers. He had a double system of purifiers, and divided the stream; and it appeared to him that the lightening of the material (practically making it all equally active for the passage of the gas) had quite as much to do with the whole question as dividing the stream. There was undoubtedly something due to both; but from his own experience in previous years, he certainly considered that lightening the material was the more important point of the two. The addition to the contact surface was, as had already been pointed out, a question of degree. What was to be the limit? They might go on adding to the surface until there was nothing but surface and no material. There was also a question whether they could get a sufficiently slow travel of the gas through a given size of box dealing with a certain quantity through a horizontal layer. They were far safer with a deeper box; and he should judge they could get quite as good an effect. This was a point for Mr. Belton's consideration. No doubt he had looked into the matter; and they expected he would lighten their darkness.

Mr. BELTON, in reply, first thanked the members for their kind reception of his somewhat feeble effort. He must apologize for presenting to them what sounded very much like a commercial paper; but the Secretary would remember that when he responded to his request that he would contribute a paper, he mentioned that this was the only thing on which he could speak at the present time. He was not there to advertise anybody's apparatus, but wished simply to tell them what he judged the thing to be worth. Mr. Shadbolt had suggested the impossibility of obtaining equal results without horizontal travel. The effect of such travel was this: They might cram an ordinary box with oxide, and they could only get it full up to within 1 or 2 inches of the top. The area of the box was unalterable without enlarging the purifier. Supposing the box to be 524 superficial feet, it did not matter whether they had one ton or twenty tons of oxide in it. If the make of gas were so many feet per hour, it could only travel through the box at so many feet per second. But if they split it up, they at once got a slower speed of travel through the box, and, therefore, a much longer time-contact of the gas with the material. This was one advantage derived from the Jäger system which had not been hitherto obtained. Mr. Shadbolt said the effect of increasing the number of walls would be to decrease the bulk of material. The quantity that could be got into a box was limited; but it stood to reason that the gas travelling from the bottom to the top of the box must go a greater distance. Taking the length of travel as 1 ft. 9 in., in winter they could not work their 24 ft. by 22 ft. purifiers with more than 1 foot of material on the grids. If they had more, blowing would result. In one case they had 2 feet of material and 524 superficial feet of contact surface. In another case they found they had 955 superficial feet, and every wall through which the gas must pass was 1 foot in depth. The gas being split up into so many streams, each particle of the gas had a much longer contact than in the vertical system; and consequently the purification of the gas was much more efficiently carried out. The rate at which the gas flowed in one case was far less than in the other, because they had more contact surface. He had been asked if the same result could not be attained by filling the purifier from the grids. He thought not. Mr. Shadbolt had given his experience of another system where a box 25 feet square gave an increase of 130 per cent.; but he did not tell them over what length of time the experiment extended. He (Mr. Belton) could give instances where his boxes had passed upwards of 100 per cent. more than usual. In his figures he had given the average over a considerable period, which he thought was the most reliable method to adopt. He was using a set of four boxes for oxide purification, and since the last change No. 3 box had passed 39 million cubic feet, and No. 4 box, 31 millions. He quite expected that No. 3 purifier, which was emptied and refilled on the 4th of March, would not require to be filled again before July; and he doubted whether any purifier on the ordinary system could go so long. With reference to Mr. Ogden's remarks about getting equal results with ordinary grids dividing the stream in the centre of the box, if the gas could be got to travel equally downwards and upwards, he had no doubt that improved results would be obtained; but the question was if it would do this. Had Mr. Ogden made tests, he fancied that he would have found considerable differences in the amount of sulphur in the layers, showing that more gas had passed through the lower one than the upper. If this took place, it at once did away with this method of increasing the purifier efficiency, and of reducing the back-pressure, though he questioned whether the back-pressure would be very much reduced by this means. Then he had been asked why he had not given the cost of the alterations. As he had started by saying, he was not there as an agent for anybody; and if the members of the Institution wanted to know what the cost of altering their purifiers would be, they had only to write to the makers, and they would very soon find out. He thought Mr. Hawkins was under some misapprehension when he asked what guarantee there was of an equal distribution of material. The material was not filled in from the top of the box. There were five layers of grids. The bottom layer was first put in, and the material filled up to the level of the grids, and so on with the successive layers; and it was found that when the box was emptied the density of the material was absolutely uniform from top to bottom. If anyone doubted this, he could come and see for himself. Members had only to express a wish to see the purifiers emptied; and he would give them notice when the operation was about to take place. He could not say yet how many changes of purifiers were required to thoroughly sulphide the oxide. Last winter he had to work with two lots of new oxide and two lots of old alternately; and he had not yet ascertained what length of time was required to sulphide the oxide. The weight of oxide put in varied according to circumstances. As to the wear and tear of the grids, if the men were careless in handling them, they might break some of the small bars; but in that case they were very easily replaced. He thought they would find, year in and year out, that the wear and tear of the grids was no greater than with the ordinary grids. It was rather early to say, but he had not had to buy any new grids yet. Then as to the cost per 1000 cubic feet as compared with the old system. There would be some economy. The economy would come in in the length of time that the boxes would run. He had not been able to accurately get at the difference in the cost of labour. There would undoubtedly be a saving on this head, though he could not say what it would be. It would be no use for him to attempt to give any figures, because they would only be approximate. Mr. Brearley had asked a very pertinent question—whether safe results could not be obtained if the depth of the material could be maintained, and back-pressure reduced; but this was just the difficulty. It stood to reason that the density of the material at the lower portion of the 2 feet was greater than that at the lower portion of the 1 foot of material. The greater the density the greater the resistance to the passage of the gas; and by reducing the density of the material in the box the back-pressure must be reduced. Therefore, it could only be done in the summer season when the make of gas was at its minimum. In answer to Mr. Buckley, it had never occurred to him to take the pressure at different positions of the purifiers. He might say that, from the appearance and from the analysis of the oxide on emptying the box, every indication was found that the pressure was equal throughout, because there was no question about the sulphide and the amount of oxide being equal from the top to the bottom of the box.

Mr. SHADBOLT said Mr. Belton had pointed out that the information he had given was insufficient; but he could not say how long a box was going to last that was not yet foul. What he

meant to say was that the boxes working in the ordinary way passed so much gas with the same oxide in use. This same oxide used with the vertical flow had already effected a saving of 130 per cent. with the same degree of efficiency; but the boxes were, like "Charlie's Aunt," still running.

Mr. BELTON remarked that what he wanted to know was whether this was the result of one change or the average during a series.

Mr. SHADBOLT said they had not yet come to the second change. What had been done so far was very remarkable. When a comparison was made between the vertical and the horizontal system, he was curious to know whether with any sort of arrangement like the one he referred to, they could not secure as good results; and his figures showed that they could. It looked to him as though nine-tenths of the efficiency was due to the lightening of the material, rather than to the horizontal flow.

The PRESIDENT then moved that a hearty vote of thanks be accorded to Mr. Belton for his very interesting paper. Like Mr. Shadbolt, it had first struck him as being to a certain extent of the type used styled "advertising;" but if they were never to read or discuss a paper on any new process or system which had been evolved, and which was in use and likely to be beneficial to their industry because it was of this type, he was afraid they would rarely learn those things that were likely to be useful to them to know. They were occasionally bound to discuss papers which were of the advertising type; care always being taken to avoid advertising the patentees, and confining themselves only to giving their experience of actual results.

Mr. SHADBOLT said it afforded him the greatest pleasure to second the vote of thanks. He hoped it would be the forerunner of many papers on subjects which were equally interesting from other members, but who, through a certain amount of diffidence, and from the idea that they might be advertising, were holding them back. Let it be an example to those gentlemen who were holding papers back for these reasons to give them similar communications, and never mind if they were advertising or not.

The resolution was passed unanimously.

Mr. BELTON returned thanks, and gave a general invitation to the members to come to his works to see the purifiers emptied.

PROPOSED ESTABLISHMENT OF THE "QUESTION-BOX" SYSTEM.

The PRESIDENT said this matter had been referred back to the Committee at the last meeting, and, as the result of their deliberations, he begged to submit the following recommendations: "That a 'Question Box' be established, and that the heads of scheme, as submitted, be approved: (1) All questions to be sent in writing to the Secretary or specially appointed Editor. (2) A Sub-Committee to be appointed to revise questions, and the Secretary or Editor to obtain replies. (3) Revised questions and replies thereto to be published prior to each quarterly meeting, and discussed by the members at the meeting."

Mr. HAWKINS seconded the recommendations, and they were adopted.

The PRESIDENT: The next recommendation is: "That this Institution co-operate with the Ohio Revision Board. (1) Questions and replies to be exchanged with the Ohio Revision Board. (2) Replies to our questions to be requested from American gas engineers, and replies to American questions to be given by our members."

The HON. SECRETARY seconded the recommendation, which was duly agreed to.

THE PRESIDENT'S INAUGURAL ADDRESS.

The PRESIDENT announced that the adjourned discussion on the Inaugural Address must stand over to the next quarterly meeting, owing to the lateness of the hour.

VOTE OF THANKS TO THE PRESIDENT.

On the proposition of Mr. HAWKINS, a cordial vote of thanks to the President was passed, and the proceedings terminated.

Visit of Members to the New Wortley Gas-Works.

The whole morning was occupied by the members in a visit to the New Wortley Gas-Works. They were met on arrival at the Leeds Railway Station about half-past ten o'clock, and went by special tram car to the works. Here the Chairman of the Gas Committee (Mr. G. Ratcliffe) welcomed the party. He was accompanied by Dr. Heald, the Deputy-Chairman, Mr. Herbert Brown, the Chairman of the New Wortley Works Committee, Alderman C. F. Tetley, the Chairman of the Meadow Lane Works Committee, and Mr. R. H. Townsley, the Chief Engineer and Manager of the Corporation Gas-Works.

Mr. Ratcliffe, in a speech of welcome, remarked that if the visit had been a few weeks later the Leeds Gas Committee would have been able to show them something that was not to be seen at any other gas-works in the country. The Committee were laying down at the New Wortley works plant for the manufacture of bricks from spent lime and clinker, and they believed there would be a very big market for the product. He expressed the opinion that the gas industry had entered upon a new lease of life. Not so long ago many people interested in gas undertakings feared that the industry was doomed to destruction; but that fear had, it seemed, proved groundless, and now their sympathies were with those who were interested in electric lighting undertakings, on account of the great disappointments they had suffered, and were likely to suffer—indeed, it was almost pitiable to see the disappointments to which these gentlemen were being subjected. He added that he approved of the movement for the general reduction of the candle power of gas—remarking that it was bad policy to have to maintain the present high standard of quality merely to meet the convenience of the few people who declined to keep up with the times by adopting the incandescent burner.

A tour of inspection was then undertaken under the guidance of Mr. Townsley, the Station Manager (Mr. Rowland N. Webb), and several of their assistants. It was seen that the works were in a state of transition, and were not so spick and span as they will be—that is to say, for a gas-works—when the modernizing scheme has been concluded. But it is during the progress of constructional work and change that the engineer finds most to interest him; and the visit on Saturday supplied no exception to this experience, for, in all parts of the works, there was attraction for everybody. Some general particulars about the works will be of interest—culled from a printed slip prepared by Mr. Townsley.

The historical note may first be made that the works were acquired from the Leeds Gaslight Company in 1870, and the land at present occupied comprises 11¼ acres.

The coal is brought in waggons from the Midland railway sidings by locomotives belonging to the Corporation, and taken by means of an overhead railway to the retort-houses.

There are in all three retort-houses; Nos. 1 and 2 containing 210 and 243 horizontal through retorts respectively, of the 22 in. by 16 in. oval ⌂ type, and No. 3 containing 176 inclined through retorts, of the 24 in. by 15 in. to 20 in. by 15 in. taper ⌂ type. Fuller information about this inclined retort house appeared in the "JOURNAL" for March 15, 1904, at which time the work was being constructed by Messrs. Graham, Morton, and Co., Limited.

No. 1 retort-house is fitted with West's compressed-air stoking machinery. Placed at intervals on one side of the house are three coal and cannel breakers, and three elevators driven by steam-engines. The coal, after being elevated, is delivered into a hopper placed under the head of each elevator, or carried to the hoppers at the other side of the bed by means of an 18-inch belt conveyor. When this house is fully working, about 270 tons of coal and cannel are carbonized per day, which quantity is dealt with by two charging and two drawing machines, working regularly at the rate of 70 draws and charges per hour. No. 2 house is fitted with the Arrol-Foulis hydraulic stoking machinery. There is a coal breaker and elevator at each side of the house; the elevators delivering the coal into one large central hopper. The charging and drawing is accomplished by four sets of machines; and these deal with about 320 tons of coal and cannel per day. A new engine-house has recently been erected, and has been fitted with two of West's single-line air-compressors, and two hydraulic pumps; it being found necessary to duplicate this portion of the plant. The new hydraulic pump was made and erected by Messrs. Hathorn Davey & Co., of Leeds, and is easily capable of delivering 125 gallons of water per minute against a pressure of 600 lbs. per square inch.

The condensing plant consists of one of Clapham's three-tower patent water condensers of a capacity of 3 million cubic feet per day, and six sets of air condensers of a capacity of 6 million cubic feet per day. The exhausters are all of Messrs. Bryan Donkin's manufacture, and consist of two of 200,000 cubic feet per hour each, and two of 100,000 cubic feet per hour each. With regard to purification, a Livesey tar-extractor, and three 3 million cubic feet per day ammonia washers of the rotary type, are in use, as well as eighteen 30 ft. by 20 ft. purifiers, six of which have the covers lifted by hydraulic rams. Four station meters are employed, each being of a capacity of 100,000 cubic feet per hour, or 9,600,000 cubic feet per day, which is about a million cubic feet more than the maximum day's make. Three of these meters were made by the Gas-Meter Company, and the fourth one by Messrs. J. & J. Braddock. This last meter was installed about five years ago.

The gas storage accommodation is provided by four holders, each of about 100 feet diameter, with three lifts, and capable of containing 2,026,000 cubic feet. The Kirkstall holder station is also in connection with these works, and has a storage capacity of 3,688,000 cubic feet; making a total capacity of 5,714,000 cubic feet. The governing arrangements comprise a 36-inch Braddock's patent equilibrium governor, a 36-inch one of Milne's make, and a 24-inch and a 20-inch of the Cowan type.

In the new boiler-house, there are three 30 ft. by 8 ft. Lancashire boilers, fitted with Meldrum's forced draught furnaces, for supplying the steam to the engines of the air compressors, hydraulic pumps, coal-breakers, &c. In the other house, there are two 30 ft. by 7 ft., and one 25 ft. by 8 ft. Lancashire boilers, fitted with Meldrum's furnaces. These are for supplying the steam to the exhausters and works in general.

In recent years, new blacksmiths', mechanics', and joiners' shops have been erected for the purpose of having all repairs executed on the works.

The Gaslight and Coke Company have been awarded a gold medal by the Cookery and Food Association in respect of the model kitchens fitted up by them at the recent exhibition, as noticed in the "JOURNAL" last week (p. 387).

THE EFFICIENCY AND PRACTICAL IMPORTANCE OF COMMON SOURCES OF LIGHT.

By Professor W. WEDDING, of the Charlottenburg Technical College.

[**Abstract Translation of a Series of Articles in the "Journal für Gasbeleuchtung."**]

(*Continued from p.* 367.)

5.—THE INCANDESCENT ELECTRIC LAMP.

The ordinary glow lamp, in which a carbon filament is heated in a vacuous space, will be first dealt with. The improvements which have been made in this lamp since it was introduced 25 years ago have been mainly in the filament, and they have not benefited to any considerable extent the specific consumption of the lamp. Two electric lamps of different candle-powers were investigated.

The first was a nominal 16-candle lamp at 110 volts; and when hung vertically this gave an illuminating power in a horizontal direction of 18·3 Hefners (=16 candles) at a consumption of 62·1 watts. The distribution of the total radiation is shown for the different angles diagrammatically by the curve in fig. 12, in which diagram the distance between any two adjacent concentric circles (the inner one excepted) represents 5×10^{-6} watts. Similarly the distribution of the visible radiation is shown in fig. 13, in which diagram the corresponding distance represents

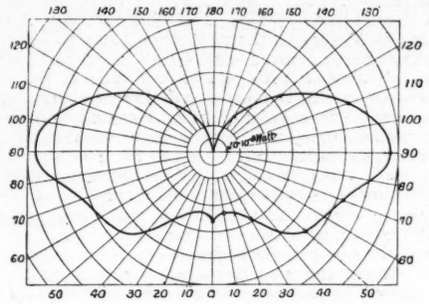


FIG. 12.

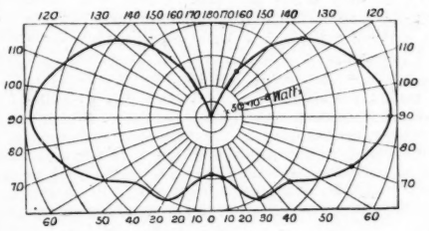


FIG. 13.

20×10^{-8} watts. The mean spherical values at one metre per square centimetre are $26{\cdot}98 \times 10^{-6}$ watts for the total radiation, and $0{\cdot}941 \times 10{-}6$ watts for the light radiation. Thus only one-thirtieth of the total radiation is converted into light. The efficiency is $0{\cdot}19 \times 10^{-2}$, and the ratio of the light evolved below to that evolved above the horizontal plane is as 1 to 1·03, or, say, 1 to 1. The energy expended when 16 candles illuminating power measured horizontally were developed was $0{\cdot}0734 \times 10^{-6}$ watts per Hefner at one metre on a square centimetre.

The second lamp gave an illuminating power in a horizontal direction of 43·8 Hefners (= 38·4 candles), at a consumption of 104·06 watts. The radiation, total and luminous, was measured at different angles; and the ratio of the light evolved below to that evolved above the horizontal was found to be 1 to 1·11. The mean spherical total radiation was $70{\cdot}9 \times 10^{-6}$ watts, and the mean spherical luminous radiation $2{\cdot}78 \times 10^{-6}$ watts. The efficiency was $0{\cdot}335 \times 10^{-2}$. At one metre distance on a square centimetre the energy expended per Hefner developed in a horizontal direction was $0{\cdot}08 \times 10^{-6}$ watts. The efficiency of this lamp was therefore about 50 per cent. better than that of the first; but it was still extremely low.

6.—THE OSMIUM LAMP.

This lamp has only limited application. On account of the low voltage at which they work, a number of lamps usually have to be run in series. Consequently only relatively large consumers can use them economically. There must be taken into account in computing the cost of light from this lamp, when used singly, the low efficiency of the necessary transformers, their cost, and the high cost of the lamp. So long as the osmium lamp can only be used with a low tension current, its general application is out of the question. The lamp examined gave, at a tension of 37 volts, and with a current of 1·317 amperes, an illuminating power in a horizontal direction of 43·3 Hefners (= 37·1 candles). The distribution of the luminous radiation is shown in fig. 14, in which diagram the distance between any two adjacent concentric circles (the inner one excepted) represents 50×10^{-8} watts. The mean spherical total radiation is equivalent to $31{\cdot}5 \times 10^{-6}$ watts, and the luminous radiation alone to $2{\cdot}413 \times 10^{-6}$ watts. The efficiency of the lamp is therefore $0{\cdot}622 \times 10^{-2}$. The light evolved below the horizontal plane is to that evolved above as sumption per Hefner in the horizontal direction amounts to

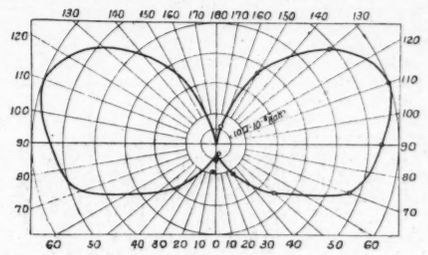


FIG. 14.

1 to 1·42. At one metre distance per square centimetre, the con- $0{\cdot}077 \times 10^{-6}$ watts. Measurements made with the Wanner pyrometer of the temperature of the incandescent osmium filament showed that it averaged about 1900° C. The change of resistance of the filament with a rise of temperature was investigated, and the temperature co-efficient of the osmium filament was found to be 0·004.

7.—THE NERNST LIGHT.

The Nernst lamp represents the class of incandescent electric lamps in which the illuminating body is within an air-filled space. In contradistinction to the carbon and osmium lamps also, it is a high-tension lamp, and is now made even for a distributing tension of 500 volts. A Nernst lamp, with vertical filament, was used in these investigations, and at 220 volts and 0·969 ampere, it afforded an illuminating power of 184·5 Hefners (= 162 candles) in a horizontal direction. The distribution of the luminous radiation is shown in fig. 15, in which diagram the distance between

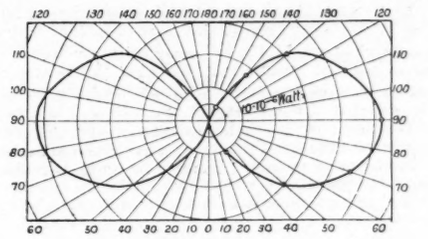


FIG. 15.

any two adjacent concentric circles (the inner one excepted) represents 4×10^{-6} watts. The mean spherical values are, for the total radiation, $223{\cdot}4 \times 10^{-6}$ watts, and for the luminous radiation $14{\cdot}38 \times 10^{-6}$ watts. The ratio of the light evolved below to that evolved above the horizonal plane is 1 to 1·04. The efficiency works out at $0{\cdot}848 \times 10^{-2}$. One Hefner in the horizontal direction visible radiation requires $0{\cdot}127 \times 10^{-6}$ watts.

8.—THE ARC LIGHT.

Development of the arc light has taken place in three different directions—viz., improvements in the carbons and the controlling mechanism, and the introduction of the enclosed arc. Five years ago the Bremer light also came as a distinct advance. Part of the light obtained was derived from the previously non-luminous arc, and the impregnation of the carbons with illuminating materials considerably improved the economy of the lamp. The carbons also were placed so as to avoid casting a shadow.

The author's investigations on the arc light consisted in determining the mean spherical radiation by means of a spherical photometer of special type. The results obtained varied, for obvious reasons, between certain limiting values, which are given. The efficiency ranged from 0·298 to $0{\cdot}338 \times 10^{-2}$; and for a visible radiation of one Hefner, the consumption was from 0·021 to $0{\cdot}0047 \times 10^{-6}$ watts.

SUMMARY.

The following table shows side by side the most important figures, as already given, for the different modes of lighting:—

Mode of Lighting.	Watt Consumption for Visible Radiation, per Hefner.	Efficiency.
Petroleum	$0{\cdot}1133 \times 10^{-6}$ watt	$0{\cdot}029 \times 10^{-2}$ watt
Incandescent spirit	0·0092 ,, ,,	0·0063 ,, ,,
Welsbach gas	0·018 ,, ,,	0·018 ,, ,,
High-pressure and intensified gas.	0·057 ,, ,,	0 0805 ,, ,,
Incandescent electric.	0·083 ,, ,,	0·34 ,, ,,
Osmium ,,	0·077 ,, ,,	0 62 ,, ,,
Nernst ,,	0·127 ,, ,,	0·85 ,, ,,
Arc ,,	0·0128 ,, ,,	0·318 ,, ,,

It will thus be seen that the value of the energy involved in one Hefner or one candle-power is very small. Generally, it falls below 10^{-8} watt, so that complete conversion of energy to light, without loss by radiation, conduction or otherwise, would result in more than one million Hefners being obtained per watt, or about a milliard Hefners per horse-power. The figures given for the efficiency, which always falls below one per cent., show further that the conversion of energy entailed in the production of light is an extremely bad one. All the sources of light in use at the present time convert almost the whole of the energy applied into heat, and the fraction which appears as visible radiation is excessively small. Therefore it may be said that no practical sources of light attain their objective. They afford a great deal of heat with the light. Indeed, the natural source of light, the sun, also affords much heat, but that heat fulfils a very important part in the existence of the earth. The heat produced in artificial lighting is, however, excessive, and in most cases injurious. It remains for inventive spirits to determine to what extent it will be possible to secure a more rational production of light, while retaining, as far as may be, similarity of colour with sun light.

Data so far given do not directly lead to any general conclusions as to the practical importance, applicability, and economy of the various sources of light. The author has dealt with these matters in the sequel.

(To be continued.)

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Early Times of Gas Manufacture.

SIR,—Major Mead's legend, which associates Murdoch as an apprentice with the drunken Hornblower, may be dismissed as an improbable one, in the absence of any confirmative evidence, since it is extremely unlikely that Murdoch could have served an apprenticeship at so great a distance as Cornwall from his parents' home in Ayrshire. So far as can be authenticated, he paid his first visit to Cornwall in 1778, on behalf of his employers, Messrs. Boulton and Watt, who had only just previously introduced their engines for use in the Cornish mines, in competition with the Newcomen atmospheric engines, with which the Hornblowers were associated.

That Murdoch was not the only person in this particular district who was possessed with the idea of extracting gas from coal, is by no means inherently improbable, having regard to the state of knowledge on the subject at the time; but it is at least as likely that Major Mead's Hornblower borrowed his ideas—if he had any—from Murdoch, as that Murdoch borrowed from him. Watt speaks in his correspondence of the uneasiness caused by the Hornblowers, "by the lies they have told in Cornwall," and characterizes them as "ungrateful, idle, insolent." On the other hand, there is Murdoch's "plain, unvarnished tale" to the Royal Society. "Nearly sixteen years" previously, he says in this, he had been induced to try the combustible property of the gases produced from coal and other substances. "Nearly sixteen years" gets us back almost to 1791, in which year he took out a patent (No. 1802) for "treating certain ores to obtain green vitriol, pigments, and composition for preserving ships' bottoms, &c.;" the method pursued being to burn pyrites with just sufficient air to support combustion, and condense the "fumes or smoke" in a receiver with the production of "a fine yellow powder." This process was certainly not one of distillation, but it does not seem at all unlikely that the experiments to which it gave rise led him to the subject with which his name is now inseparably associated.

15, *Victoria Street, S.W., May* 12, 1905. CHARLES HUNT.

Fire-Brick Material.

SIR,—With reference to the abstract, in the "JOURNAL" for the 2nd inst., from Dr. F. Leisse's valuable paper, I think Continental gas managers have been a long time in finding out the advantages of silica material for regenerator furnaces, as they have been used in gas-works in this country for more than twenty years. But Dr. Leisse points out that silica bricks should be used as heat radiators, and not only as heat resisters, in preference to fire-clay bricks; and this advantage has, I think, escaped the attention of gas managers. It may also be of interest to your readers to know that silica brick retorts are being adopted in several gas-works with success; but care should be taken to get the right percentage of silica, and the material should have the advantage of neither contracting nor expanding during manufacture.

Oughtibridge, May 8, 1905. F. H. BROOKE.

SIR,—In the "JOURNAL" for the 2nd inst. there was published an abstract translation of a very interesting paper by Dr. F. Leisse, the Chemist to the Cologne Gas-Works, in which he gives his experience in regard to fire-clay compared with Dinas material, and finds the latter better than the former in high heats. As I have found exactly the same results, it may be of interest to publish them. We have for many years used the very best fire-clay material for our regenerator settings, and have so far been satisfied with it. But two years ago we built 18 new settings with 20-feet through retorts, eight in each setting, and therefore having combustion chambers 20 feet long. Five of the settings were constructed with silica bricks throughout; and the remainder of the same design, with first-class fire-clay bricks, regarded as the best on the Continent. They have now worked for 500 days, and the result has been that the combustion chambers in the five settings are as good as new, and quite horizontal, whereas all the others have sunk in the middle to the extent of from 3 to 5 inches—so much, indeed, that it has been very difficult to work with our machinery in the middle retorts lying over the combustion chamber, these retorts being bent to the same degree. The five middle retorts in the settings built with silica bricks were elevated a little. The heat in this chamber is, of course, very high; and the fire-clay bricks have shrunk too much. The silica bricks expand slightly; and for this reason it is good to have a little room between the cross walls and the main arch of the setting. It has now been necessary to place two new retorts in the parts of the 13 settings built with fire-clay material; and it is hoped that the arches will not go down much farther.

After this experience, I have come to the conclusion that good silica bricks are preferable for combustion chambers to fire-clay bricks, when these are not burnt harder than is now the case.

Copenhagen, May 10, 1905. J. O. V. IRMINGER.

The Mechanical Handling of Material.

SIR,—The tilt-bucket elevator and conveyor is now a prime favourite for the mechanical handling of coal and coke in gas-works, and coal and ashes in power stations for tramways and electric lighting stations. In view of the claims put forth, in recent books and catalogues, that the American engineers forestalled us with the tilt-bucket elevator and conveyor, I wish to put on record, in the columns of the "JOURNAL," the early British history of this now favourite appliance in the automatic handling of coal and coke. When I compiled my first catalogue for my first Company, about fourteen years ago (a copy of which I send herewith), I inserted illustrations of the tilting-bucket elevator and conveyor. For six years I tried my hardest to get a British engineer to adopt it, but unsuccessfully. When I compiled a new and expensive catalogue for my first Company, six years after the other, I actually left out the illustrations of this appliance, believing there was no market in Great Britain for what is now the favourite form of conveyor.

A year after my second catalogue, an American firm erected an installation of the tilt-bucket conveyor and elevator at a large electricity works in Glasgow. A second firm advertised for a like installation; and I sent in a tender. The agents of the American firm were down on me like hawks for an injunction to restrain me from using their patent. I took a copy of my antiquated catalogue to the company who had the contract to place, and I got it. Since then I have not heard any more claims about the tilt-bucket conveyor and elevator being of American origin.

Smethwick, May 12, 1905. GILBERT LITTLE.

The Making of a Successful Gas Man.

At the close of the remarks, in our editorial columns last week, under the above heading, it was mentioned that, as the subject is a many-sided one, we should be pleased to have our readers' views thereon. A correspondent has accordingly forwarded a few particulars in regard to his career: "On leaving school, soon after I was fourteen years of age, I served two years with a leading local Architect and Surveyor. I then entered a well-kept, modern 80 million cubic feet gas-works, where I served for eight years. During this time the works were rebuilt; the best modern plant being installed. I kept all the books, and was practically Assistant to the Manager for four years. At the age of 21 I secured the silver medal of the City and Guilds of London in 'Gas Manufacture.' During the eight years I took private lessons in technical subjects, and secured certificates in chemistry, building construction, mechanical drawing, steam, machine construction, sound, light, heat, electricity, &c. When 24 years of age, I won a County engineering scholarship, and for two years did the curriculum work for the degree of B.Sc.; going through the intermediate course in chemistry, physics, and mathematics. In addition, I took a general engineering course under a professor who was a D.Sc. and a member of all the engineering societies and institutes. The course included civil, mechanical, and electrical engineering; and I secured about half the prizes offered to the different classes. I resigned my scholarship (which was residential for three years) at the end of the second year, to take an appointment as Manager of a gas-works. Since I have held this, the works have been extended and improved, the consumption has trebled, the price reduced, and, instead of being worked at a considerable loss, there is a net yearly profit. With the assistance of an office lad, I conduct the business, commercial and engineering. My employers are pleased with the manner in which the works are conducted, and give me the best testimonials as to ability and character. But, after taking all the trouble I have done to be efficient, it seems to me to be a waste of education and money, seeing that I can only command the princely salary of about £150 per annum. I have therefore come to the conclusion that there must be something besides training, experience, and qualifications to make anyone 'a successful gas man'—financially."

The Gas Exhibitions and Cookery Demonstrations in North London Suburbs.—The exhibitions of gas-stoves organized by a group of local ironmongers at Hornsey, Crouch End, and Muswell Hill, in co-operation with the Hornsey Gas Company, to which reference was made in the "JOURNAL" last week, were well attended, and the cookery demonstrations were followed with evident interest. Something like 20,000 invitation cards were sent to householders, with the result that the halls were filled. We understand that sufficient business has been done to cover expenses; while that which must come from the enterprise of the promoters of the exhibitions will go to produce a respectable credit balance. In the domain of lighting, a noticeable feature at all the exhibitions was the very fine display of incandescent lighting with the Edgar group of arc lamps and novel fittings. The "Eclipse," "King," and "Ajax" lamps were much in evidence, and elicited favourable comment as to their unique design, construction, and suitability for exterior lighting.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thirteenth Day—Tuesday, May 9.

(*Before Mr. Justice* GRANTHAM.)

Graham, Morton, and Co., Limited v. Compagnie L'Union des Gaz. The Milan Gas-Works Contract.

The hearing of this important case was resumed to-day.

Mr. RUFUS ISAACS, K.C., Mr. J. A. SIMON, and Mr. A. M. PADDON (instructed by Messrs. Spyer and Sons) appeared for the plaintiffs; Mr. J. A. HAMILTON, K.C., and Mr. A. H. SPOKES (instructed by Messrs. Waterhouse and Co.) represented the defendants.

Mr. *A. A. Johnstone*, who was called the previous day (*ante*, p. 377), was further examined by Mr. HAMILTON, and said the result of the faulty fuel beds was that the fuel was badly burned, and this caused irregular heating. He saw that the clinkering was done properly; but, notwithstanding this, he found the greater part of the combustion was at the back, where it should not have been. The unequal heating would be shown in the quality of the gas which went up the duct. Witness took gas from the duct, analyzed it, and found that the carbonic acid passing up varied from 7 to 14 per cent., whereas it should not have exceeded 3 or 4 per cent. This showed that only about 66 per cent. of the fuel was being utilized in the settings. When he made this experiment, he took care to see that the furnaces were being worked properly. In his opinion, the Bourne furnace, when altered from plaintiffs' system, was an improvement, taking the results of the gas produced as compared with that made by plaintiffs' furnaces. He agreed completely with Mr. Marshall on this point. In plaintiffs' setting there were no means of regulating the heat as between one chamber and another; and the construction was quite inadequate. The proportioning of the outlets through which the gases passed was also wrong, as there was only enough space allowed for four chambers as was allowed to the other one in a bed of five. He found it necessary to have a very great draught to properly heat the settings. This was due to construction, and not to any fault in the working. As to the nostrils, they had been carelessly formed, and there was a great want of uniformity. Irregular nostrils produced an irregular supply of gas to the combustion chambers, and they became blocked more quickly. He thought it was an impossibility to clear such twisted nostrils as those in the plaintiffs' settings, when once they were blocked, without cutting away some of the brickwork. There was an accumulation of material in most of those he examined, which would alter the flow of the gas passing through them.

As to the regenerators, he examined them from the front, and found bye-passing in many instances, particularly at the back part. He also analyzed the volumes of gas at various parts of the regenerator in beds Nos. 1 and 2 in bench No. 4. He took samples first at the inlet, then 3 feet below, then 6 feet below, and finally at the damper. The results were as follows:

	Regenerator A.			Regenerator B.	
	CO per Cent.	O per Cent.		CO per Cent.	O per Cent.
At the inlet	15	3	..	15	4
3 feet below	14	4	..	14	5
6 ,, ,,	8	10	..	9	10
At the damper	7	11	..	8	11

	Regenerator C.			Regenerator D.	
	CO per Cent.	O per Cent.		CO per Cent.	O per Cent.
At the inlet	9	11	..	8	12
3 feet below	9	11	..	6	14
6 ,, ,,	4	16	..	6	14
At the damper	4	16	..	4½	15½

Mr. HAMILTON: In each case, as you got lower the proportion of oxygen in the volume of gas steadily increased from 3 or 4 to 11 per cent. What does that uniform increase indicate?

Witness: It shows that air found its way through the division walls between the secondary air chamber and the waste-gas flues.

Except through cracks and bye-passing, can the atmospheric air come in and increase the oxygen?—No.

Did you find anything which would account for this development of cracks and bye-passing?—The division walls were built of ordinary bricks laid in the usual way, brick on brick, except in every third course, where the bricks were locked or dovetailed to a closed vertical joint; but in the other cases there was no such locking. The horizontal joint was bedded in the usual manner.

Mr. Graham said the weight of the wall was what he relied upon to keep the joint tight. What is your experience of the ordinary sound way of constructing such a wall?—My experience is that every joint should be lapped, whether horizontal or vertical. The heat would make a wall built as this was expand considerably.

Was the wall reasonably sound and free from defects?—The wall as a wall was well built, and the bricks were well bedded; but I found that it had developed cracks, and it could not be otherwise. These cracks gave an opportunity for bye-passing.

MR. JOHNSTONE'S OPINION OF THE SETTINGS.

In reply to further questions, witness said he did not think the damage which took place was caused by direct firing. If this had been the case, he would have discovered in the gas-duct much more extensive damage than was found. The coal used was of good average quality; and he should have been satisfied to use it himself at Ilford. As to the explosions, the state of the retorts showed that these had little or no effect on them. He complained of the fact that inverted arch-blocks were dropped into one place, the result being that the work had sagged; while silica bricks, which were highly expansible, were employed in places where it was not advisable to use them. The pier-walls, as a rule, were well built; but the joints were abnormally thick, and the parts behind the face-bricks were filled with rubble, which was unsound work. There was no proper key to the arches; there was irregular setting, and no adequate bonding of the whole. In resetting an installation, it was usual to keep the arches; so that they must be well constructed. He had known arches in an installation last some fifteen years. Generally speaking, in his opinion, the piers and the arches were not of good workmanship. As a practical man, he saw nothing that could be done with these works except to demolish them. Where common bricks were exposed to great heat, he thought there should be over them at least 14 inches of refractory material. He made a test in June, 1904, the producers being clinkered every 16 hours; and the result was that in No. 1 setting the coke used per 100 kilos. of coal carbonized was 18·48 per cent. In No. 2 setting, the quantity needed was 17·46 per cent. Though the retorts were in good condition at the commencement of the tests, they were in such a state at the conclusion that the coal was simply going in at one end and coming out at the other. He attributed this failing of the heat to the falling off of producer gas owing to the blocking up of the mouths with clinker. As a rule, a good setting should not need clinkering more than once in 24 hours. He had heard the evidence of the plaintiffs' experts, who said the bad results of the working were due to bad management; but he found no evidence to support this opinion. He thought the bad results were due to the method adopted of dealing with the gases—viz., the irregular distribution of them. He should consider the cost of properly resetting the 32 beds would be about £25,000.

MR. JOHNSTONE'S CROSS-EXAMINATION.

Cross-examined by Mr. ISAACS, witness said he understood the system adopted by the plaintiffs; but he thought it had been wrongly applied. It might work if properly carried out. The one he used himself was much better than that adopted by the plaintiffs. Both were the same, but were differently applied. The regulation of dampers was an important matter which required the attention of someone familiar with the system, as the results depended to a great extent upon it. Dampers might become fused, but he did not remember such a thing in his experience. His evidence was based on what he found at Milan. He assumed that the retorts had been properly worked. Mr. Marshall first approached him on this matter; but he did not say there was a lawsuit pending. He had later a letter from the Company, however, in which this fact was stated. He did not know anything of the difficulties with the workmen and the stokers at Milan, but he assumed that the stokers were made to do their work. In a furnace of this description, the stoking and clinkering would be of great importance; and this ought to be supervised by someone who thoroughly understood the working of the installation.

Mr. ISAACS: Assuming that for eighteen months the stoking and clinkering had been irregularly done, would that not have had a serious effect on the results?

Witness: I think not.

Would the neglect to clinker have an effect?—It would not only reduce the temperature, but affect the productive capacity of the setting generally.

Suppose the men were allowing the gas-duct to become unsealed by charging every two hours, what would happen?—It could cause fluxing.

Do you pledge yourself that if the producer is charged every two hours any damage would be caused to the installation?—I say that the function of the producers is deranged by taking the lid off, which relieves the pressure and lessens the volume of gas going into the setting.

Do you say that this has any effect on the setting?—It allows secondary air to come in which should not.

Do you know they charge every two hours at the Crystal Palace Gas-Works?—I do not say it is wrong; I say it may be avoided.

If you have a system by which the gas-outlet is uncovered every two hours you must re-charge then?—Yes.

Do you suggest that the condition in which you found the brickwork had anything to do with the bad working of the setting?—I think the failure is more attributable to the design; but the brickwork is not what it ought to be.

THE QUALITY AND WORKING OF THE SETTINGS.

In further cross-examination, witness said he might have gone a little too far when he said the whole of the bad results were due to the irregular distribution of the gases in this system; but, at any rate, this was one of the main reasons. The bad brickwork might have had something to do with it also. He should not have passed the brickwork himself, though he was aware the arches and pier walls were used by Derval in the resetting, but he expected after repair. Walls in such works as these would crack; but they ought not to have cracked in such a way as they did at Milan. If a setting was badly used and badly worked, it might crack more than it would do otherwise. He had had to work with a fuel bed less than 3 feet thick; but he held that satisfactory working could not result from a 2-feet bed. He had heard that both at Leeds and in Edinburgh the fuel beds were much less in depth than his; but his own experience was that satisfactory results could not be obtained from shallow fuel beds. The experiments he carried out on the grate-bar area were made on the furnaces altered to the Graham and Morton plan. He thought that in these settings they would always get more or less imperfect carbonization of the coal used. He also considered that in the producers as designed by the plaintiffs premature combustion must always occur at certain times; but, in his opinion, this would not necessarily cause any fluxing—at all events, to the extent of demolishing a setting. He would not agree with anyone who said there could not be fluxing at the tail of the chambers. With regard to the blocking of the nostrils, he could not tell how long it would take before they would be blocked, as this would depend upon circumstances. He could not say in how many nostrils he saw pieces of brick, which must have been left there from the building, but a great number. It was impossible for them to have got there during demolition. There might have been probably a dozen in

this condition; and he should think he saw 20 or 30 altogether. He did not take a specific note of how many were blocked up with material left from the time of construction. This blocking must have more or less affected the working of the setting from the beginning. Some of the nostrils were partially fluxed.

In re-examination by Mr. HAMILTON, witness said Mr. Marshall was practically a stranger to him when he was first approached with regard to Milan, and he formed an entirely independent opinion on the settings. His judgment was not affected either by what Mr. Marshall thought or by the fact that contracts had been made with Derval. He found no signs to show that events which had happened during the working with regard to the Company's men would alter the inferences he drew. If there had been excessive draught causing very great heat, he should have expected to find signs of it all over the installation—not more in one place than another, as was the case in regard to plaintiffs' work. His experiments at Milan proved that it was impossible to get sufficient heat in the upper chambers without overheating the lower ones.

MR. CORBET WOODALL'S OPINION OF THE SETTINGS.

Mr. *Corbet Woodall* said he first visited Milan in November, 1902, in connection with the matter before the Court. He found the heats were very bad in the settings; they were unequal, and not sufficient to properly carbonize the coal. At that time his attention was drawn to the fact that the Directors were trying to carry out a series of tests. He thought it was utterly impossible that reliable tests could be conducted under the circumstances of the time. The Company were being pressed for gas; and he suggested that the tests should be postponed—a suggestion to which he understood Mr. Graham agreed. He went again to Milan in May, 1904, when one of the benches was in process of demolition and the others were working. He thought, speaking generally, the failure of the bench had been due, first, to the small area of the grate of the producer; and, secondly, to the manner in which the gases had been distributed in the bench. Personally, he preferred a fuel bed of 5 or 6 feet; and he thought there was general agreement on this point. It would have been quite easy, with the space at their disposal, to have a deeper fuel bed. He thought the shape of the producer accentuated the difficulty, as the fuel sloped away from the front and from the duct. It was undoubtedly objectionable to open the furnace doors too frequently, either for clinkering or for charging, as this could not be done without allowing air to get in. He felt it was particularly undersirable to have a shallow bed at Milan, because everybody knew that the men there were not the most reliable, and that probably there was greater difficulty caused by this circumstance than might have been the case elsewhere. He agreed with the evidence given both by Mr. Marshall and Mr. Johnston that if there had been direct firing, as the plaintiffs' witnesses had suggested, which caused the bad working, there would have been more signs of it at the duct. As to the nostrils, they all differed from the original drawing, as there was no uniformity in construction, and they went at different angles. They seemed to him to show an utter want of supervision. He knew the work was required in a hurry; but he considered there was a want of supervision about it which was deplorable, and somewhat reprehensible. He thought there was not one of the nostrils which could have been properly cleaned out without cutting out the brickwork; while the graduation was taken up the wrong way. He had very little to say about the brickwork except that the keys of the arches were thin and the joints too thick. He thought locked joints were very desirable; and he agreed that the experiments made by Mr. Johnstone and M. Freyss proved that there had been bye-passing. He was of opinion that the installation, as it was built, was incapable of carbonizing 300 kilos. of coal per charge with 15 per cent. of fuel. He knew Dean's Primrose coal well; and it was used a great deal by gas companies. It was a fairly good coal, but not first class. He thought it was impossible to do anything with the installation except to reset it, for which he thought £25,000 was a fair sum.

MR. WOODALL'S VIEWS OF THE POSITION AT MILAN.

In cross-examination by Mr. ISAACS, witness said he had not had any experience of inclined retorts when he first went to Milan. He admitted that it would not have been fair to plaintiffs to make the test in November, 1902; while he also thought that no test made at that time could have been a reliable one. He knew at that time that it was very easy for any evil-disposed person to ruin the whole of the settings in Milan. The danger was, of course, owing to labour troubles. Anyone could, by meddling with the dampers, get up the heats, melt the internal portions, and flux some of the internal parts. But this might happen to any setting, and not to plaintiffs' in particular. He wrote to this effect to the defendant Company, as he wished to put them on their guard. When he went out to Milan in 1902, he did not find the management satisfactory. He had reported that the brickwork of the setting, when he first saw it, appeared to be very good. He went about the works with Mr. Bourne, who he saw was a very reliable officer; but he had been through a very trying time, and had lost his *verve*, and appeared to be cowed by the men. He was a very loyal servant and a good engineer. There was a complaint about the quality of the coal; but he (witness) thought there was nothing in that which would affect the result of the working. If the coal was very bad, it would do so; and it was, of course, the elemental factor in the case. He admitted that to have a piece of carbon in the retorts of the size of that produced in Court showed that there was not proper working, and its formation might be helped by back-pressure. He was satisfied that the arrangements were not such in November, 1902, as would have allowed large quantities of coal and coke to be dealt with as they would be in ordinary working. It was easy to get up the retorts to a particular heat, and thus produce certain results; but the only test which he should think was reliable was one in which the whole of the benches were treated as one unit—as if it were in actual working.

Fourteenth Day—Wednesday, May 10.

Mr. *Corbet Woodall*, continuing his evidence, informed his Lordship that the price of gas in Milan had been 4s. 1d. per 1000 feet, and that it was now 3s. 4d. The maximum quantity of coal used in the works was 600 tons per day, of which half would be dealt with by the Graham and Morton settings. He had learned these figures by inquiries from the Company. About 10,000 or 11,000 cubic feet of gas were produced from a ton of coal.

Mr. ISAACS then continued his cross-examination by asking witness if there was any serious defect in the furnace that was being used which was a matter that would become apparent to any person of experience very soon after he started working, in the furnace itself.

Witness said there was, because of the unusual amount of attention the furnace would require. Assuming it was necessary to charge the producer every two hours, there would be no objection to it. He himself would rather change at shorter intervals; but he did not put it forward as a grave complaint. In the case of the London installations, they only charged every two hours, not because it was necessary to do so, but because it was convenient. Questioned as to his report, witness said there was a degree of freedom in his criticism of the works, because it was made without contemplation of its coming before a tribunal like the Court.

Mr. ISAACS: That is what makes it so valuable. There is no doubt that, when you were at Milan in 1904, you did see in the furnace that was being demolished evidence of direct combustion?

Witness: Yes, as I said yesterday, with a fuel bed of the depth there it is practically impossible to avoid it.

But that must depend on the care you take to prevent your gas-duct outlet being unsealed?—It does; and the difficulty that must be experienced anywhere was intensified at Milan.

Because of the labour trouble, it was impossible to get the men to take care that the gas-duct outlet was not unsealed?—All I desired to say was that the depth of fuel was so small that it would be always difficult, and would be so anywhere, to prevent unsealing of the carbonic oxide duct. Under the circumstances at Milan, that difficulty was greater than usual because of the labour trouble and the want of capacity of the average Italian workman in comparison with the English workman. It was exceedingly difficult to get them to work, as they were so independent.

MR. WOODALL'S FURTHER VIEWS OF THE SETTINGS.

Cross-examination continued: He had never had any practical experience of working with low fuel beds. During the time he was taking part in the management of gas-works, it was the practice to have fuel beds 5 or 6 feet high. He did not wish it to be understood that he was not actively concerned in management. When he was the Engineer of a Gas Company, it was before the period of regenerator firing at all. The present practice, so far as he knew it, as followed in works under the most competent direction, was to have a deep fuel bed; and there was no reason against it, as far as he was aware. It avoided the difficulties and dangers which had produced bad results; and he could not see why it should not be followed.

Mr. ISAACS: We have got the fact that there was direct combustion, and the result of that must necessarily be fluxing?

Witness: In the spot where the direct combustion takes place.

And there is no doubt that if you have fluxing at the tail of the tongue, that would be the best evidence you could have of direct combustion taking place?—It would be evidence.

Would you tell me about the nostrils? Did you also find, in dealing with them, when you examined them in 1904, that a number were fluxed?—I noticed that a number were choked with fluxed material, and my recollection is that there was some evidence of fluxing in the mouth of the duct, but not to any great extent. There was evidence of glazing over the brickwork at the mouth; and it showed that there had been considerable heat.

That which you saw in the nostrils did not in any way cause the blocking of them?—No; the blocking was caused just in the way described. It was chiefly by material that seemed to have run down from the top into the nostrils. I was astonished at the flippancy with which that matter was dealt with, because it seemed to be striking evidence of the want of proper supervision of the work.

Do you mean that what came from the top was fluxed material?—Yes; it fluxed above and ran down.

Could that state of things exist without a competent person becoming aware of the fact that there was fluxing of that character going on?—The first evidence he would have would be the faulty heating of the retorts, and consequently the faulty carbonization.

Justice GRANTHAM: Competent persons ought to have been alive to the possibility of that when they found bad results?

Witness: Yes.

Mr. ISAACS: And the result would be that if you had this faulty carbonization going on for any length of time it must be obvious to anyone with elementary knowledge that there must be fluxing of that character going on at the top of the setting?

Witness: I do not think that follows. There are other reasons that might account for the bad results.

Was it your view that the Company could pay Messrs. Graham and Morton in consequence of what you had seen of the settings in November, 1902?—I cannot definitely say "yes." When I made the suggestion, I had no anticipation of the complete breakdown of the benches. What I suggested was that there was a certain amount of retention-money, and that they should add £1000 a bench, and then there would be no difficulty in paying the balance.

Re-examined by Mr. SPOKES: He knew of no other fuel bed so shallow as the one in question. So far as he understood from Mr. Herring, the depth of the fuel bed at Edinburgh was exactly the same now as it was when it was designed—viz., 3 feet. He (witness) did not go to Milan between the end of 1902 and May, 1904, so that he had no direct knowledge of what was going on; and he was not consulted in the interval. There was no evidence in May, 1904, when he went there, that any evil-disposed persons had been trying maliciously to wreck the plant. He found no evidence, on looking at the retorts, that the explosions had injured them. If they had caused any injury, he should have expected the retorts to be damaged; but they were all in good condition. The whole scheme of testing was a silly pretence; there was no substantiality about it. He presumed that a

test was going on, but he never realized for a moment that it was an official one; and he advised that it should be put on one side, feeling that it was a folly. The tests with regard to illuminating power were equally illusory. The nostrils of the settings were perversely ingenious, and designed to be as troublesome as possible. There was not one of them that approximated to the drawings, either in form or direction.

Mr. Trewby Relates his Impressions of the Settings.

Mr. *G. C. Trewby* said he was one of the first to make a trial of the Coze system of inclined retorts; and he had superintended the construction and working of a great many installations. In May, 1904, he went to the San Celso works in company with Mr. Johnstone, and met Mr. Marshall and Mr. Corbet Woodall at the works. He viewed the settings which were in course of demolition. From what he saw of the work inside the settings, he thought it was anything but creditable. There were scarcely two nostril holes alike; and instead of being carried out according to the drawings, inclined from the gas-duct into the setting, they ran at right angles to the duct, and then in a vertical direction. The wall between the combustion chambers was not at all satisfactory; and instead of being solid, it was filled up with plastic material. He looked at the retorts for evidence of unequal heating, and easily found it. There were zones of intense heat and other parts where there was not sufficient heat. In his experience, the minimum amount of fuel which should be left before filling the regenerator was from 3 to 4 feet, and then the regenerator should be filled up to a depth of 6 feet with fuel. He said it was quite impracticable to charge at more frequent intervals than every two hours, because it would increase the labour enormously. The less the producer was opened the better. He made an experiment with the gas-duct—testing it, in order to see if there was any vacuum or pressure in it, because in a proper system of working, there ought to be pressure there. He found a vacuum in the duct leading to the front; equal to about ½ inch of water. This did not seem to be much; but it was a very large proportion of the whole vacuum, because he worked his settings with only 0·2 inch, and here there was nearly ⅓ inch taken up in drawing the gases away from the producer. He wanted to see if this was on the producer itself; so a test was made by a very delicate registering instrument for an entire 24 hours. He found on the top of the producer it was practically in a state of equilibrium. This proved that it was the narrowness of the gas-duct which necessitated the vacuum to take the gas away from the producer; showing that the duct was not sufficiently large for the work. It was therefore necessary to have a higher speed and a greater draught than usual to get the gas up. The section of the carbon monoxide duct was too small, and should have been twice the area. There was no difficulty in making it this size. The principal evil was in the design of the combustion chambers; and the vital defect was having the two combustion chambers in direct communication with the down passage. It would be impossible to alter the combustion chambers without removing the retorts.

Cross-examined by Mr. Simon: He had heard the evidence of Mr. Corbet Woodall and the preceding witnesses; but he could not say that he agreed generally with all their answers. He was at one with them so far as their answers were concerned with the settings with which he was personally acquainted. When he was at Milan in May, 1904, his attention was directed to the producers; and he knew they were in the form to which they had been changed by Mr. Bourne. In his opinion, they were a great improvement. Having regard to his experience, his predeliction was for a producer of a different shape from the plaintiffs', with a much deeper fuel bed. He admitted that an installation of this kind was a delicate piece of mechanism, and had to be carefully and skilfully managed. He did not quite see how the settings could be destroyed by bad working.

Mr. Simon: Have you not heard evidence that unskilful, not to say malicious, working might do a great injury in a short time?

Witness: I do not know in what particular you mean. I cannot see to what extent damage could be done.

But if you used the dampers unskilfully, you might produce an excessive, and even a dangerous, amount of heat?—In a properly constructed setting you would produce a dangerous heat all over it.

Re-examined: He did not agree that the test presented was a reliable one as to what would happen in normal regular working. It was a test that would be made for the purpose of ascertaining what could be got out of the retorts by a false heat. He saw no evidence of malicious or unskilful persons having tampered with the dampers. If anything of the kind had taken place, he would have seen indications in parts of the settings other than the two combustion chambers.

A Retort Builder's Evidence.

Mr. *Edward Masters*, the Managing-Director of Messrs. Gibbons Bros., Limited, said he had had 35 years' practical experience as a builder of retort-settings, and had erected many settings of inclined retorts. He went out to Milan in May, 1904, and made a careful inspection of the bench then in course of demolition. In his opinion, the brickwork had been very badly done, and there was not the least reason for making the carbon monoxide duct so small. He had never put up settings on this system, but had always built them with an open furnace, and not with bifurcation. The nostrils had been made by very careless workmen with no supervision.

In cross-examination by Mr. Simon, witness said he thought, if he had had the work to do, he could have done it much better. His firm sometimes got contracts, while at others they went to Messrs. Graham, Morton, and Co.; but he did not think the two firms had ever come into contact. Witness was cross-examined in regard to a book issued by his firm, and written by Mr. Samuel Wellington, a gas engineer now in Colombo. He explained that he was not a technical expert, and had no intention of repudiating any statements in the book. He admitted that an increased draught would have a bad effect, and might do a great deal of damage; also that it needed more skill and care to manage a regenerative than an ordinary setting. When he saw the settings, he did not know that they had been worked by the defendants' servants for eighteen months. As he saw them, they would not produce satisfactory results.

Re-examined: He thought the cracks in the brickwork were due to bad workmanship, and not to excessive heat.

The Chairman of the Company Tells His Story.

Mr. *Arthur Lucas*, the Chairman of the Continental Union Gas Company and of the London Committee of the Union des Gaz, said the Milan Gas-Works were directly under the London Committee of Directors; but the Committee never came to a decision of importance without consulting their Paris colleagues. The Continental Union Gas Company owned the major portion of the shares in the Union des Gaz. There were six Directors of the Continental Union Company, and there were in Paris three Directors of the Union des Gaz. The Directors of the Continental Union Company were also Directors of the Union des Gaz; and therefore the Board of the latter consisted of nine Directors—those in London being practically a working majority. They had entered into contracts with M. Derval and the Stettin Company for the reconstruction of the Graham and Morton benches. These contracts were in process of being carried out, and the Company were liable in regard to them. Mr. Bourne was the head man in the works at Milan, and he would not do anything without reporting it through M. Solanges, the representative of the Company. He had no authority to vary the contracts with Messrs. Graham and Morton, or to decide anything under them.

Mr. Hamilton: When the Board waived the tests the contract provided for in 1902, and did not have the tests in 1903, was there any intention then to take the installation over for better or for worse?

Mr. Isaacs said that was a matter of inference to be drawn from what took place.

Justice Grantham remarked that that was so.

Cross-examined by Mr. Isaacs, witness said Mr. Green was a perfectly competent engineer, in whom they had every confidence, but they practically relied on Messrs. Graham, Morton, and Co. They left the matter entirely in the plaintiffs' hands, as they had nobody to look after their interests.

Justice Grantham: Have you ever heard of any other Directors acting in such a way?

Witness: No; but the circumstances were peculiar. We asked them to take the work under great pressure, and we felt that as they only had a short time, we ought not to interfere with them in any way. We were very pressed for time.

Mr. Isaacs: But the contract provided that the work was to be carried out to the satisfaction of your Engineer at Milan.

Witness: I had forgotten that.

And Mr. Bourne reported to you regularly every week?—Yes.

Cross-examination continued: Neither he nor the Board ever heard anything of the alleged official 16 days' test, or of the reports on it. He had never seen any such reports, though he knew that tests were provided for in the contract before the plaintiffs were entitled to be paid. He could not remember that there was any test which was interrupted by Mr. Woodall. He (witness) left all technical matters to Mr. Green and Mr. Woodall. Witness went out to settle the labour troubles; but luckily he came back. The Italian workmen were very much disheartened by their surroundings. With the fire and smoke in summer time, it was like a Pandemonium. No doubt Mr. Bourne had complained of some of the coal; but coal varied very much.

Evidence of Mr. Bourne.

Mr. *Charles Bourne* was the next witness. He said he had now retired, on a pension, from the defendant Company's service; but from 1901 to 1904 he was in their employ at the Milan works. He was engaged by them in 1882, prior to which time he was ten years at Newcastle in a coal merchant's office. His father had built gas-works, and as a boy he was brought up in them. He entered the defendants' service to look after the coal, and was eventually made Assistant-Engineer at the San Celso works. After filling this position for 5½ years, he became chief of the distribution department; and after another four years he became Chief Engineer in 1893. He had had five years' experience of the system of carbonizing coal in inclined retorts by means of secondary air introduced into the carbon monoxide duct before the plaintiffs came on the scene. M. Solanges was the Manager of the whole of the Company's works, and witness was under him. When the plaintiffs finished their work in 1902, there was considerable confusion at the works, and winter was just coming on. Witness watched the construction of the new settings, and supervised the brick-setters several times a day—looking after them as well as he could, having regard to his many other duties. His assistant, Fumugalli, was there, engaged in making the foundations, and he was always on the spot. It was in January, 1903, that he commenced to alter the furnaces and grates; and it took until June. He was led to undertake this because the furnace required 29 men to do the work of four. They had to clinker every eight instead of every 48 hours. They got much better heat after the change, and it was more regular. The principal reason for the modification was to economize labour. He saved 25 men a day. He was acquainted with the necessity of attending to the draught in inclined retorts; and he found that they required much more than usual because of the stoppage of the nostril holes, and the coal was not carbonized. He did his best with the air-slides and dampers, and tried to have them kept properly regulated; and he was successful. There was nothing wrong with the regulation of the dampers while he was there. The stoppage of the nostrils was a practical difficulty from the very beginning; and the cleaning of them was most troublesome. They accomplished it until November, 1903, when the stoppages were of such hard matter that they could not get it out. They occurred to an extent greater than he should have expected in ordinary working. They went on fairly well during the summer of 1903. It was the angle of the nostrils which caused the difficulty, and prevented proper cleaning after November, 1903. It was not correct that the installation was working well in December in that year, or that he told plaintiffs that it was. A charge of 300 kilos. was much less than an ordinary charge for a 20-feet retort. He should expect such a retort to carbonize 400 kilos.; but he could not put in more than 300 kilos. because of the stoppage of the nostril holes, which prevented proper carbonization. For at least six months in 1903 they were working the Graham retorts alone; 17 per

cent. of coke used for the whole amount of coal carbonized was the best result he got. When plaintiffs started, it was 22 or 23 per cent.; but he gradually got it down to 17 per cent., and it remained at this during all the summer. He did his very best to get successful results out of the Graham retorts.

Cross-examined by Mr. SIMON: He quite understood that his position entitled him to see that the work of construction was properly done; and he acted on this idea. The work was properly done, so far as he could see. It was done in the summer, when less gas was required. If things had not been properly done, he should have called his superior's attention to the fact. He did not refer to the plans, because he did not think he was responsible for the system of construction; but he supervised the materials and workmanship. In December, 1902, he felt quite satisfied that he could make the benches work; and he expressed that opinion to M. Solanges and Mr. Green. In view of the results which he obtained in the first half of 1903, his expectation was justified to a degree, though he had hoped to do better. He altered the form of the producer because he thought it would be an improvement. He found that the workmen were careless, and lost the torches on purpose. They did everything they could to annoy the witness; and this kind of conduct continued right along from the big strike in November, 1901. He had labour troubles for six years. From time to time the coal supplied was very damp, especially in wet weather. Witness did not agree with the demolition of the benches. He had already sent in an estimate for the modification of the nostril holes, and had ordered the necessary material. The cost would have been £20 per bed. When M. Freyss first came to Milan, he opened all the dampers more than they had been opened during the time witness had regulated them. The effect of this was that the heats rose very rapidly, and the coke came out carbonized to a white heat. This involved a raising of the temperature inside the settings. Of course, this was not right. M. Freyss went out to make experiments, and witness received notice on the 22nd of March and left on the 31st. At the end of a week of M. Freyss's experiments, witness was almost without gas; and he spoke to the Manager (M. Solanges), and said he must take over the management of the benches again, or otherwise he would not be responsible for lighting Milan. He did not complain to M. Freyss.

Re-examined by Mr. HAMILTON: He knew of no damage that was caused by M. Freyss's experiments. He took the whole lot of benches in hand again, and got the same results as before. When the work of demolition was proceeding, he saw no injury which he could attribute to M. Freyss's experiments. In modifying the nostrils, he intended to make them straight instead of angular, so that they would work properly. At that time he was not aware that there was anything wrong with the wall and the combustion chambers. He did not think that the explosions caused by the men to annoy him did any harm; and he never found the dampers tampered with. He never discovered any deliberate attempts to interfere with the proper working.

Fifteenth Day—Thursday, May 11.

EVIDENCE OF THE DEFENDANTS' CHIEF ENGINEER.

On the resumption of the proceedings to-day,

Mr. *W. H. Green* was called and examined by Mr. HAMILTON. He said he had been for a great many years in the service of the defendant Company, and was still in their exclusive employ as Chief Engineer. In January, 1902, he received instructions to go to Edinburgh: but prior to that he might have seen the specifications which plaintiffs drew up for this contract, though he did not quite remember. He went to Edinburgh principally to see the settings there, and the style of workmanship of the benches. There was also a detail as to a type of hydraulic main, because they had had a great deal of trouble at Milan with pitch forming in that part of the plant. He saw Mr. Graham and Mr. Herring at the New Street works. No doubt certain drawings were sent for and produced; but he could not swear that day as to any of them, and he had no recollection of the particular ones which Mr. Graham and Mr. Herring said were submitted to him. He had no recollection of Mr. Graham producing a fresh drawing which had been prepared for him at Leeds the night before, or of having his attention called to any drawing showing the general arrangements of the producer, the gas-duct, the nostrils, the combustion chambers, and the retorts for Milan. When he said this, he did not in any way call in question Mr. Herring's word of honour. He took a drawing of a hydraulic main with him, and it was discussed with these gentlemen. On the 13th of January he made his report, five days after the interview, and there was no reference in it to any drawing of the general arrangement, or any discussion or explanation. He did not see the Granton settings at work; but he saw the New Street works. He could not see anything of the interior arrangements, however; but so far as he could inspect the installations, he was extremely pleased with them. He could not say when the tracing of the internal arrangements arrived, but the first time he saw it was after the 2nd of December.

Justice GRANTHAM said he must draw attention to two lines of witness's report which seemed to be conclusive on this matter. He took witness to be a man of experience and reliability, and he went up to Edinburgh for the purpose of seeing everything he could for the advantage of his Company. He (his Lordship) assumed that the witness did exercise his ordinary skill and ability, and in his report he said: "Mr. Herring explained the settings to me in his office, and then put me in charge of the Works Engineer." What could that mean?

Mr. HAMILTON proposed to ask the witness.

Justice GRANTHAM said he did not think Counsel ought to ask him, after he had given his explanation very fairly.

Mr. HAMILTON said he thought the simplest way would be to ask Mr. Green what the words "explained the settings to me" referred to.

Witness said Mr. Herring explained to him his own drawings of the Edinburgh Granton settings; but what the drawings were he could not swear to now. They were all on the most friendly terms, and were talking about these things in a general way; but now he could not swear to any particular drawing.

Justice GRANTHAM remarked that witness was hardly doing himself justice.

Examination resumed: He had from time to time visited plaintiffs' works at Leeds, and seen plans there. He could not say that he asked them then to supply him with a general arrangements plan. When he visited Milan before November, 1902, he did not make any minute inspection of the interior arrangements of the works. The impression he got of the work then was that it was excellent and of good quality, and he so reported. It appeared so from the outset. His reports were always made from absolute knowledge of what he was writing about. He left all the minute particulars to Mr. Bourne, who was on the spot. He could not remember the longest visit he paid to San Celso while the settings were being built. On the 15th of December he said there need be no more tests. Between Dec. 2, when the tracing of the internal arrangement was received at the office, and Dec. 15, he had no recollection of having seen that tracing. In May, 1903, he was in perfect agreement with Mr. Bourne in altering the generators; and he recommended this course. He explained that the reason why this was not done before the work was completed was that the plan of the internal arrangements had not come forward. The work had to be rushed through, and the defect was not discovered until the settings were in operation. In February, 1904, he went to Milan to see the demolition of bench No. 7, and was there all the time it was in progress. He had heard the evidence of Mr. Johnstone in criticizing the design, and that evidence was absolutely his view. The workmanship inside bench No. 7 might have been better than it was; but he did not pay any particular attention to detail or make notes. He was examining the design principally. He saw signs of fusing and burning in chambers Nos. 1 and 9. The chambers graduated; but the bottom ones were the worst. Some of the nostrils were choked; but he did not remember that fused material from above had caused this. He was also at Milan in April, and what he saw then absolutely confirmed what he had seen in February. He had always hoped they would be able to do without demolition of the retorts; but, as a practical man, he came to the conclusion that demolition was the only course.

MR. GREEN'S OPINION OF THE SETTINGS AND THEIR WORKING.

Cross-examined by Mr. SIMON: He did his best to see that the work of construction of the settings was done properly. On Dec. 16, 1901, he made a report in reference to the plaintiffs' tenders, and said he saw nothing to delay their acceptance. This was before he went to Edinburgh. He was the person employed by the defendants to advise them on the technical aspect of the contract. He saw the New Street works in operation; but he did not ask the depth of the fuel bed. To-day he would ask the question; but at that time he did not consider himself an expert, though he was sent out on this matter.

Justice GRANTHAM: Why did you go then?

Witness: Because I was sent, and I thought I ought to go.

Mr. SIMON: Did you not go to make yourself better acquainted with the matter, and get Mr. Herring's explanations?

Witness: Certainly; and I did make inquiries to a very great extent.

But you did not ask about the fuel beds?—No.

In further cross-examination, witness said that, knowing what he did about Italian workmen, it was always in his mind that some of them might tamper with the settings. He admitted that the materials he saw were excellent. As to the tracing of the internal arrangements, he knew that it was a necessary plan which must be on the spot to enable the works to be carried out, and he was frequently in the office of the Contractors at Milan during the progress of the work in 1902. He went out to see how the work was being carried on, and he obtained information of a practical nature from Mr. Bourne. From this and from what he saw himself, he came to the conclusion that the work was being excellently done. He had other business to attend to while he was at Milan, so he could not devote all his time to these works. He went round occasionally, as each bench was finished, to see the heats being got up; and the sight-holes were taken out so that he might look up the nostrils and see what the combustion was like. He found that the nostrils were working properly. His reports were as accurate as he could make them from the information he had. If they started new settings at full blast, there was much danger of damaging them, and there was also the danger of evilly-disposed persons causing injury by tampering with the dampers and thereby ruining the settings and the retorts. He saw the installation at work during some time in November. He thought that 286 cubic metres (10,100 cubic feet) of gas ought to be obtained from each ton of coal carbonized. If 284 cubic metres per ton were obtained during six months, that would be a pretty good test. He did not know that the Graham-Morton system of installation did not require the use of Boghead cannel to enrich the coal. From what he saw of the stokers in November, 1902, they were a bad lot, and were out of touch with the management. He then recommended that the inclined retorts should be used as much as possible, to save labour. A month's official test was commenced on November 16. Very likely this arrangement was made between himself and Mr. Graham. At that time Mr. Bourne had an idea that it was a good thing to produce much coke and little gas; coke being a valuable commodity in Italy. Witness reported that the system was all nonsense, because an enormous stock of coke became a drug in the market. That criticism would not apply in all circumstances. A change from 6-hour to 5-hour charges would not necessarily damage the installation; but it would upset the basis of any test. In the early stages of using a new installation, the heat should be gradually raised, and there should be no violent fluctuations. He was strongly against the use of wet coal, because it was a waste all round. One day the coal was like powder, and another it would be like mortar; and he so reported in May, 1903. He had reported that the design was "A1," that the installation was solidly built, and of the best materials; but at that time he did not know what the ovens were. He understood that they were to get the Edinburgh settings. They were good enough for Mr. Herring, and therefore he took it that they were good enough for him. He went and saw them working, and asked innumerable questions of those in charge; and he was satisfied that they were working very well indeed. He thought in November, 1902, that the Graham ovens and beds were well designed, and he formed this opinion from what he had seen at Milan. He had often warned the people there not to force the retorts, because they had done so with the Stettin retorts and

had damaged them. If he used the word "ruined," it was an extravagant term; but no doubt the retorts were seriously damaged. They went on working the Stettin retorts when they were like a "dog's hind leg." These benches had been reconstructed since they were first built. In his opinion, the explosions were likely to do harm, and he would not allow them, though he could not say that they had done damage in this case. Damage was more likely to occur with a 20-feet retort. Having gone out to advise the Company, he satisfied himself, and advised them accordingly. The installation was a delicate piece of mechanism, which anyone, however honestly disposed, if ignorant, might injure by overheating, which would cause fluxing.

Re-examined by Mr. SPOKES: When he made his reports about the design being satisfactory, he knew nothing of the shape of the nostrils or of the other internal defects.

In the course of the re-examination, Mr. Spokes asked witness to "brush up his memory" and to "pull himself together;" whereupon his Lordship remarked that Counsel was treating his witness very badly, as he thought he had given his evidence very fairly.

ADDITIONAL EVIDENCE FOR THE DEFENDANTS.

Mr. *Jesse F. Scott* said that if the total cost of resetting the four benches was £25,000, the amount attributable to the upper half of them would be from one-third to two-fifths of the whole cost.

Mr. *Harold J. Morland* said he had ascertained from the defendants' books that the total cost of demolishing and reconstructing the four benches was approximately £22,054.

Mr. *J. Eastman Blow*, at present the Assistant-Engineer at the San Celso works, said he had been there since May last year, and before that had paid visits to the works while he was at Genoa. In September, 1903, he was there with Mr. Green, and found that the retorts were being worked at a low heat, and that the coke was coming out incompletely carbonized. He also noticed that the heating was patchy and very irregular. Some of the retorts were better than others, and no two were alike. He saw benches Nos. 4 and 5 working; the others were being demolished. They were working with 12-hour charges; but when Mr. Leech was there, they reverted to six-hour charges. The result was most unsatisfactory. The stokers refused to go on with the work, as was quite natural, because of the extra smoke and flame; and it was very difficult and unpleasant to get the coke out.

Cross-examined by Mr. SIMON: He had been moved about a good deal, and was not at Milan between May, 1902, and March, 1904. He was there in August, 1904, when Mr. Leech was there. He remembered that on the 31st of August Mr. Leech asked him to go with him to examine the back gas-dampers. Witness, as an assistant, refused to go without instructions from his superior officers. Asked if he said he thought he should find signs of faulty working, he replied that he did not remember that precisely. He had not a clear recollection; but he might have said it. Questioned as to the visit of the experts on April 18 and 19, 1904, he said he had no idea that they were coming, or he should have taken care to work the retorts in a normal manner. Mr. Marshall was surprised at the heaviness of the charge taken out of the retorts on the 19th, and so was witness. He did not remember telling Mr. Leech in August that the tests would be of no service, as they were not taken under proper conditions. He remembered that in January this year Mr. Shoubridge pointed out to him that the Stettin benches were not being properly worked; and he said that a few of the retorts were carbonizing badly. Witness thought that this was unimportant, because they were making 10,500 cubic feet of gas per ton regularly. Mr. Marshall did not know the circumstances. He admitted that Mr. Marshall reprimanded him, and he replied that he did not mind, because it was a small matter. He explained that one of the retorts was broken and worn out, and Mr. Marshall was satisfied, and practically withdrew what he had said. Witness made it clear that it was not his fault. Mr. Marshall pointed out that the retorts were getting too hot, and were not properly filled; but they always did get very hot. Witness invariably carried a revolver on his night watches.

Re-examined by Mr. SPOKES: The Stettin retorts were practically on their last legs when Mr. Marshall and Mr. Shoubridge saw them. He did not go to see the back gas-dampers when he was asked, because he did not want to be mixed up with this case. Witness carried a revolver, but he never had any trouble with the Italian workmen. The plaintiffs had trouble, because they did not know how to manage them.

AN ITALIAN WITNESS ON THE WORKING OF THE FURNACES.

M. *Ottorino Fumagalli*, examined by Mr. SPOKES, said there were 10 grate-bars in the furnaces at Milan. He succeeded in working them at an expenditure of 15 per cent. of fuel. The tests made were not regular or reliable as to what the furnaces would do, by reason of the system chosen for making the tests. First of all, only one furnace was taken every 24 hours.

Justice GRANTHAM remarked that he did not think this evidence made any difference.

Mr. SPOKES submitted that it was important.

In further examination, witness stated that it was possible to take one furnace every 24 hours, and arrange it so that a little fuel would bring it up to a sufficient heat. Then it was started with the generator almost full, and the next morning it was nearly empty; so that the full rate of the producer was to the benefit of the contractor. The four dampers outside were not unskilfully worked. There was no bad working, that he could discover, at the furnaces between January, 1903, and March last year. Every precaution was taken to manage the four external dampers properly. Until the month of January the dampers were regulated by the plaintiffs, and afterwards by the defendants' men as well as was possible. He did his best to keep the fuel above the opening of the carbon monoxide duct.

Cross-examined by Mr. ISAACS: Owing to the smallness and shape of the generator, after 1¼ hours the coke arrived at the level of the entrance to the carbon monoxide duct, with the original shape. The coke would not last to the level of the duct for two hours. Asked if he disliked these settings, witness said there was no gas; and it was certainly not pleasant to work with them. At first things were going on very badly; but after the Company took over the furnaces they tried to get a larger make of gas. Some improvement was made, but the production was never what it ought to be for the size of furnace.

Justice GRANTHAM: In your opinion, the furnaces were on a bad principle?

Witness: Yes.

You always thought so?—At first I thought they were not bad; but I was forced to come to another conclusion by the results.

Mr. ISAACS: How long was it before you concluded that they were bad?

Witness: About six months—after the alteration of the inclined grates.

Do you know the tests were made by arrangement between Mr. Bourne, Mr. Green, and Mr. Graham?—No.

Did you not know that Signor Chiese was put on the tests with Fransette?—They were put on by the Company to act as foremen.

Were you not taking part in the tests?—During half of the time.

Were you responsible for the number of bars that were put in the Graham furnaces when restored?—When we altered the grates, I put in the exact number there was before, as used in the Graham system—viz., ten. They were the same bars.

FURTHER EVIDENCE FOR THE PLAINTIFFS.

Mr. *Leech*, recalled, said there was no dispute as to whence came the pieces of fused brick. They were taken and notes made at the time. Witness superintended the construction of the furnaces, and each had seven 2-inch bars. He did not actually put the bars in, but he was responsible. It was put to witness that it had been suggested that there were ten; and he said he could understand this. They were removed when clinkering, and practically any number could be put in. It was possible to fill up the grate if one liked.

By Mr. SPOKES: He had not seen drawings showing how many bars were in a grate. He did not think it was usual for drawings to show the number of bars; but any practical man would know how many should be put in. It was important to some extent, because if they put in too many, they would reduce the grate area. The working space between the bars would be from 2⅛ to 2⅜ inches.

Mr. SPOKES: Do you not know that where the best results are obtained there have been 2 inches?

Witness: No; I do not.

Have you a scrap of paper to show there were only seven?—No; I have not.

Did you mention the number to Mr. Graham?—No.

Did not you start with twelve and then pull out two?—No.

You can increase or diminish the number of bars at will?—Yes.

Are you sure that no alteration was made in the number?—No; I have no recollection of anything of the kind.

When they restored the ovens, did you complain of the number of bars?—No; I did not think it was of sufficient importance to notice.

Justice GRANTHAM: What is the life of a bar?

Witness: It would last perhaps three months.

This concluded the evidence, and it was arranged that the case should be adjourned till Saturday.

Sixteenth Day—Saturday, May 13.

THE SUMMING UP FOR THE DEFENDANTS.

Mr. HAMILTON to-day summed up the case for the defendants. Dealing first with the issues in the action, he said there was one raised by the plaintiffs' claim, and another raised by the counterclaim. Upon the claim, the issue was whether the plaintiffs were entitled to the balance of the two contract sums. The contract was a lump-sum contract, and it made no difference whether the amount was paid in instalments or at once. The law was perfectly well established that one could not recover a lump sum on such a contract if one had departed from its terms. In this case, there were two items in which, on the plaintiffs' own evidence, they had departed from these terms. The first was the nostrils, and the second the execution of the arches. As to the former, the contract provided that the nostrils were to conform to the drawings. Article 2 said: "It is clearly understood that such inspection by defendants' engineers in no way binds the Company for any omission or deviation on the part of the Contractors from the drawings or the terms of the contract." After what his Lordship had intimated, he was going to assume that he would accept as statements of fact, in regard to what took place in January, 1902, when Mr. Green went to Edinburgh, the versions of Mr. Herring and Mr. Graham. Assuming that his Lordship took the view that the tracing of the plan of the internal arrangements was prepared by Mr. Graham the night before, and that he showed it to Mr. Green, it was manifest, from Mr. Graham's own evidence, that there had been a departure from the drawing, and not a departure of a mere technical kind, but one which entirely altered the problem of cleansing. And unless his learned friend could show some new contract, of which there was not one particle of evidence, binding the Company to vary the contract sued upon, the work executed was not in this respect the work contracted for. The other matter was also one that had been admitted by plaintiffs' witnesses Tranfield and Leech—the people who actually executed the work. Article 12 of the contract provided that the arches were to be built of 9-inch red bricks constructed in two rings, set at an angle of 33 degrees. It was admitted by Tranfield, and, he thought, also by Leech, that, after laying their heads together, for some reason or another which was immaterial, they built the arches with only one ring of 9-inch bricks. It was well-settled law that it would not do to give your purchasers something which you said was quite as good. If you gave him a different thing, you could not recover under a lump-sum contract. In these two respects he (Counsel) said that, apart altogether from the counterclaim, there was an answer to the plaintiffs' claim for £4000.

Justice GRANTHAM remarked that, to follow the matter out to its logical conclusion, according to this the plaintiffs could not recover £4000, and defendants could recover against them all they had paid.

Mr. HAMILTON said he did not think that, because it was a different form of action. He was not suggesting that they could recover anything of the kind. On the counterclaim he claimed damages, because the installation as erected did not satisfy article 62 in the contract. Defendants alleged inherent faults and defects in the design and in the workmanship, and breaches of the contract that the workmanship should be of the best. These came under the three heads of the guarantee of the full success, in every respect, of every part of the installation. Another form of it was the guarantee that each retort would properly carbonize in six hours, in regular normal working, 300 kilos. of dry coal used in Milan. If he established that in each case the workmanship was slovenly, that it was such as to produce inherent defects in the installation or inherent faults other than wear and tear produced by fair treatment, that the installation had inherent faults and defects in its design, that it could not be, and was not, a full success in every respect, without any fault on the defendants' part, and that it could not guarantee, in regular normal working, to carbonize 300 kilos. of coal in six hours, then the defendants became entitled to damages. It was another question as to how much; and very likely the legal mode of dealing with damages was that his Lordship might, as a jury, give some round sum. In principle, there was no doubt defendants would be entitled to damages if he established any one of these things to his Lordship's satisfaction. Beyond a bare denial of the facts, the plaintiffs set up two affirmative answers. One was that defendants had done all the damage themselves, that they had wrecked the installation, and that they had only themselves to thank. The other answer was that there had been some sort of an acceptance in the year 1903, which was—he did not quite know in what way—supposed to be an answer to the counterclaim. His learned friend had not opined that what happened in 1903, when, as it was said, the benches were taken over, constituted in itself a legal answer, assuming that there were any of these inherent vices and breaches of contract. But it was suggested that, apart from the evidence which the taking over afforded, it constituted a legal answer to the particular guarantee about the proper carbonization in six hours. The words "in regular normal working" evidently applied to the life of the thing, and not to the specific matter of tests which were preliminary to the payment of £30,000. Dealing with this part of the case, which turned on the conduct of Mr. Green, Mr. Bourne, and Mr. Corbet Woodall in 1902, assuming that his Lordship accepted the evidence that Mr. Green saw the tracing of the plans in January, 1902, if Mr. Green saw it with his eyes, he did not take it in with his mind, because he did not direct his mind to the internal design and arrangements. Mr. Graham, Mr. Green, and Mr. Lucas said, in substance, that reliance was placed on Mr. Graham's reputation as a maker of this sort of plant. Mr. Graham said he would expect his customer to place reliance on his competence and reputation. Mr. Green said he understood he was going to get what Mr. Herring had got; what was good enough for Mr. Herring was good enough for him. Mr. Lucas said the whole mental attitude of his Board was that they relied on the Contractor to properly perform his contract; and therefore there was no ground on which it could be held that Mr. Green did, in fact, approve of the tracing or the original of it in January, 1902. Whether he saw it or not, he did not give to it any approbation. This was his (Counsel's) first point on the matter. His second point was that if Mr. Green purported to give approbation, there was not a particle of evidence that he had authority to do so on behalf of the Company, and that, under the contract, if he had given it, and had authority to give it, the contract would still have bound the plaintiff to perform their contract in full.

Mr. ISAACS remarked that he did not contend that Mr. Green had authority to vary the contract. The point he made was that Mr. Green having seen and examined the plan, and passed it in his own mind as good, was evidence of the fact that the installation, if constructed according to the design, was good. He did not say that the fact that Mr. Green had seen the design prevented his learned friend saying that the installation was not properly constructed in accordance with the guarantee.

Mr. HAMILTON said he was much obliged for the explanation. Mr. Green having approved the design, it might well be that, when he came there and said he was satisfied that it was a defective and vicious one, his Lordship would be invited to prefer his 1902 opinion to that given in 1905. He appreciated that his friend would say that Mr. Corbet Woodall expressed himself in warm terms in 1902, when he had been in Milan; and Mr. Bourne was also in 1902, and at a later date, evidently of the opinion that the Contractors had done their work properly. But he submitted that no great weight attached to such evidence, for this reason: Mr. Green went to Edinburgh in order to see a thing that was new to him. He was dealing with two persons of acknowledged experience in the business; and from that time onwards until the dispute, he accepted their view that it was a good design. Mr. Bourne's competency to criticize such a design as this was not in the least established, and was much less than that of the other gentlemen who had training which fitted them to criticize the design. Mr. Corbet Woodall expressed a favourable opinion at a time when the whole of the benches were closed up and completed. He did not get inside and see the design; and his attention was not drawn to a criticism of the design. He was satisfied that, on the question of tests, there was no opportunity of making a fair and satisfactory test under working conditions with winter coming on, insufficient gas storage capacity, Milan starving for gas, the gas-works working from hand to mouth to supply it, the concession imperilled if the gas supply failed, and not only the turmoil produced by building operations in the midst of gas producing operations, but the further turmoil by the civil war existing between the workmen. So that his opinions at the time were not inconsistent with those he now expressed after he had seen the interior, learned something about the working, and considered the matter *de novo*. He asked his Lordship to attach little, if any, weight to the circumstance that down to March or April, 1903, the defendants' advisers, and therefore the defendants themselves, thought that, as far as the installation was concerned, the contract had been performed. No complaint was made by defendants then, because they had not had their attention directed to the matters of which they now complained; and no doubt until December, 1903, there was no communication which could be called a complaint. All these were circumstances on which his learned friend was entitled to rely, and which he should admit were of weight, if they were not followed in 1904 by a body of evidence which he submitted was conclusive proof of breaches of contract. No doubt there was a controversy in the evidence of witnesses of great eminence. He asked his Lordship to entertain a perfectly respectful opinion of the evidence of Mr. Herring, Mr. Hulse, Mr. Hunt, Mr. Shoubridge, and Professor Lewes on the one side, and Mr. Johnstone, Mr. Trewby, Mr. Corbet Woodall, M. Freyss, and Mr. Marshall on the other. The other witnesses occupied different positions. Mr. Graham had every motive for taking a favourable view of what he saw. He could not help thinking that a man who had so much at stake must have looked at the work through a certain kind of roseate atmosphere, which must be borne in mind when he spoke about its merits. On the other hand, his learned friend was entitled to say that the evidence of Mr. Bourne and Mr. Green was tinctured with some feeling that their employers had committed themselves to a certain course which had to be justified, although their credibility was not open to serious question. Of Mr. Herring, the only thing that he had to remark which qualified his independence was that he was the father of this design. He was the patentee of a portion of the design. On the other hand, beyond the fact that Mr. Marshall and M. Freyss had received fees from the Company for work done, nothing could be said against their impartiality. Of the working witnesses, the same could not be said. As to the work itself, there were certain things which he submitted were proved beyond all possibility of question, and which were discovered when the benches were demolished. It was no good trying to get away from the fact that there was striping in the retorts and deep discoloration in two of the chambers in each half of the setting, and not in the upper ones. It was no use trying to get away from the signs of fusing and the localities of the fusing. It was no good disputing the cracks or the photographic evidence of the way in which the bricks were set and the character of the bricks. These were things which had been proved and not contradicted on the other side. The same thing was true of the shape of the nostrils. The only evidence against these things was that of Tranfield and Leech, who were bound to say that everything was perfectly done. He submitted that the evidence throughout proved that the work had been deplorably done, although he made no complaint about the materials used. Now, as regards the design. There had been a fallacious use of the term "system," which seemed to suggest that Mr. Graham had some system which was the thing defendants contracted should be supplied; and therefore if Mr. Graham had given them his system with good workmanship, the defendants had got what they bargained for.

Mr. ISAACS: But we have given you a guarantee.

Mr. HAMILTON, continuing, said the only system here was the regenerative furnace system, although, of course, there was one part covered by Mr. Herring's patent. Defendants did not quarrel with the system in that sense. What they said was that it was the application of the system which was inherently vicious, and the carrying out of the system. They wanted a regenerator furnace, and contracted for it; and if Mr. Graham had supplied a producer of proper shape and size, and with a proper depth of fuel-bed, there would not have been a word to say about his patented system. What he did say was that, by reason of defects in these details, the design was inherently vicious. He had been perpetually challenged with two other installations—those at Edinburgh and Leeds—and the argument suggested was how could he say the system was vicious if the same system was applied at these two places and worked well there; but he thought he had a grievance if an argument of that kind was to prevail with his Lordship. The drawing produced of the Edinburgh settings showed a salient difference in the design; and Mr. Herring might well be able to make a success of different settings, which the defendants could not be expected, and were not bound, to make at Milan. He submitted that, under this contract, they were not to be told that the thing ought to be a success merely because the same thing in other hands at Edinburgh might be a success. As regards Leeds, there were several salient differences in the design; and he asked his Lordship not to decide against the defendants in the face of the evidence that had been given about the Milan settings, on the ground that other settings similar, but different in material respects, worked under other conditions, were alleged by those in charge to be perfectly satisfactory. Having dealt in detail with the various alleged defects, and the evidence on both sides in respect of them, he came to the question of damages. He admitted that defendants were not entitled to the whole expense of rebuilding, because certain portions would in any event have to be reconstructed after a number of years; but he contended that defendants were entitled to damages for the bad workmanship, and for such of the

ANALYSIS OF MILAN WORKING RESULTS.

Taken from the Books of the Compagnie L'Union des Gaz.

Quality of the coal carbonized: Wet, small, Durham slack. No cannel was used. The coal was measured; so that according to the Gas Engineer's report, Nov. 1903, 10 per cent. extra should be allowed for the water in the coal above the weights given below.

OFFICIAL TEST NOV. 17, 1903, TO DEC. 3, 1903.

Coal Carbonized per Charge.	Fuel Percentage.
312·39 kilos.	12·92

The Guaranteed Charges were 300 kilos. each and Fuel Percentage 15 Per Cent.

During this period 43,383 tons of coal were carbonized by the Graham Benches.

SIX MONTHS' WORKING RESULTS, JAN., 1903, to JUNE, 1903.

Coal Carbonized per Charge.	Gas Made per Ton.	Fuel Used per Cent.
306·2 kilos.	10,190 cubic feet.	14

The Cost of Carbonizing per ton during Eighteen Months was:—

Graham Benches	1s. 4½d. per ton.
Stettiner Benches	2s. 3d. per ton.

expense of rebuilding as was rendered necessary by such bad workmanship, and for the departure of the plaintiffs from the design and drawings and the contract. He also contended that defendants had acted properly in having the installation demolished. In conclusion, he submitted, on behalf of the Company, who had undoubtedly taken great care to get at the truth, that, in the first instance, they were led to rely too much on Mr. Graham, by reason of the reputation which his firm and the Edinburgh settings had. When the contract was completed, by reason of the difficulties that arose, they postponed the tests and acted on the assumption that the Contractor had taken care to do what he had contracted to do. Subsequently, in the beginning of 1903, they, in good faith, assumed that the faults shown were not radical, and that the installation might be made to work satisfactorily; and it was only after prolonged, skilful, and well-directed efforts that they were reluctantly driven to the conclusion that it must be demolished. He thought his Lordship must unhesitatingly come to the conclusion that the counterclaim for breaches of contract had been proved beyond all question, and that the theories which had been advanced by plaintiffs to account for the defects were theories which had not been supported when he considered the evidence of the Milan witnesses.

At the conclusion of Mr. Hamilton's speech,

Mr. Justice GRANTHAM said he had listened with very great attention and care to Mr. Hamilton's most able address; but, in justice to the parties, he thought it was a case in which he should not be justified in calling on Mr. Isaacs to reply. He should therefore deliver judgment on Monday.

Seventeenth Day—Monday, May 15.

THE JUDGMENT.

Mr. Justice GRANTHAM, in delivering judgment, said: I hope it will not be thought that, as I have not called on the plaintiffs' Counsel to reply to the learned Counsel for the defendants in this case, and particularly by my not reserving judgment after a hearing of 16 days, that I have not paid due attention to it, or given due weight to the evidence that has been called by the plaintiffs and defendants, and to the able speeches that have been made. But as, in all cases without a jury, I have long made it a practice only to hear the Counsel against whom I think my judgment ought to be given, and give judgment at once, I see no reason to depart from my usual practice merely because of the length or the importance of the case. It is a very important case, not only from the amount involved (something like £70,000 or £80,000), but from the issues raised between the parties, involving as they do not only the large sums of money at stake, but, what is of more importance, the character and reputation of a large commercial firm in this country.

The original claim of the plaintiffs for £1483 5s. 4d. is admitted, and is not in any way in dispute. But the defendants contend that the plaintiffs have failed to perform certain large contracts for the erection at Milan of four benches of retorts, containing in all 288 retorts, the contract price for which was £77,656; and that in consequence of that failure they (the defendants) are entitled to heavy damages. By the contract, the benches were all to be tested by the defendants for 30 days; and the balance of the contract price, less £4000 of retention-money, was to be paid by defendants to plaintiffs on the provisional acceptance of the said installation by the defendants. The £4000 retention-money was to be paid to the plaintiffs two years after the installation had been provisionally accepted, subject to any inherent defects developing themselves during that period in the working of the furnaces. After the action was commenced, an additional claim for £4000 was added to the original claim for £1483 5s. 4d., in consequence of the two years having elapsed since the date of the provisional acceptance; so that the plaintiffs now claim £5483 5s. 4d. The defendants, therefore, suggesting no defence at all to the claim for the £1483 5s. 4d., say that, in answer to that claim and the claim for the £4000, they are entitled to large sums amounting to something like £70,000 for damages, because the plaintiffs did not fulfil their contract, which was, in the main, to provide an installation of gas-retorts which would carbonize 300 kilos. of dry coal used at Milan in six hours, or 240 kilos. in 4¾ hours, by an expenditure not exceeding 15 lbs. of coke per 100 tons of coal carbonized. This practically is what the contract was for; and the plaintiffs undoubtedly guaranteed this result from the proper working of their installation. They also guaranteed many details in construction, all of which affected, more or less, the specific performances of the installation above mentioned, as to the quantity of coal carbonized. If the installation would do that work, it may be taken that the contract was performed; for, if it failed in the other guaranteed details above mentioned, it is pretty certain that it would not perform the work guaranteed.

If the defendants succeed in showing that the plaintiffs committed breaches of their contract by failing to build such an installation so guaranteed, and in consequence of which damage resulted to them, then to the extent of that damage they are entitled to set it off against the claim of the plaintiffs—not only for the £4000, but also for the £1483 5s. 4d.; and not only are they entitled to do that, but they are also entitled to recover, under their counterclaim, any sum beyond these amounts so due to the plaintiffs which will recoup them for such extra loss as they have sustained. The defendants, by their pleadings, claim in this way from the plaintiffs £70,000, or such less sum as they might succeed in proving to represent their damage, and which sum would not only outset the plaintiffs' claim of £5483 5s. 4d., but would leave a large sum beyond, which they are now seeking by these proceedings to recover. As I said before, not only is the amount involved in this inquiry very large, but, what is of more importance than the money at stake, the character and reputation of the plaintiffs' firm as one of the leading makers in Europe of these most complicated, difficult, and costly works for the making and supply of gas to the large towns not only of England but of Europe at large—a reputation which, according to the evidence of the defendants' witnesses, was, until these proceedings were commenced, unsurpassed in this or any other country. The defendants have, therefore, the labouring oar—the onus is thrown upon them of proving such breaches of contract on the part of the plaintiffs as to entitle them to such or some damages. With the exception of comparatively a small sum which the plaintiffs admit might be due for latent defects in the work, the defendants have, in my judgment, failed to prove their right to any damage at all, and failed to prove the serious charges—practically charges of fraud—made by them against the plaintiffs.

The history of the case is remarkable, and, so far as my experience is concerned, quite exceptional, and does not reflect very great credit on the defendants in making such serious charges against a firm who did so much as it was admitted by the defendants' witnesses the plaintiffs did to assist the defendants in fulfilling their own contracts with the authorities at Milan. It is true that people must be just before they are generous; but in their efforts, I suppose, to be just to their shareholders, they certainly have not been generous in their dealings with the plaintiffs, as far as their defence in this action is concerned. Never was an instance in which work of such magnitude was done under such difficulties as this work was begun, continued, and completed by the plaintiffs. Never were contractors, according to the evidence of the defendants' engineers, so anxious to fulfil their obligations, and spend their money lavishly to enable them to carry out loyally their contract with the defendants. Never did such work receive such commendation by the persons for whom it was done, during its progress and after it was completed, as in this case. Yet two years afterwards—or it may be a year or eighteen months afterwards—without the slightest complaint until they were asked for the payment of money admitted to be due and that had accrued to the plaintiffs, they accuse the plaintiffs of what amounts to the grossest fraud in the construction and erection of these works. Instead of using good and contract material, they say they used bad material, bad bricks, broken bricks, chippings of bricks, common bricks, and, in fact, rubbish in general, where they ought to have used different material and bricks of a different character, and in places which are subjected to almost the greatest heat that any work can be subjected to in this or any other country. I dare say they did use half or broken bricks for many of the fillings; but the defendants seem to forget that the best builders the world has ever known—viz., the Romans—almost invariably used similar pieces of brick for their fillings. If they had, in my judgment, used them in any place where it was injurious to use them, I should have to that extent found damages for any injury the defendants had sustained; but, in my judgment, they did not.

The defendants' Counsel considered that his clients were prejudiced by the plaintiffs having the right to begin; but all I can say is that had the defendants begun I doubt very much if I should have allowed the time of the Court to be occupied by hearing the plaintiffs' witnesses at all. The defendants had an almost impossible task to perform. They had taken over the whole of the installation after a partial test with which they were in raptures, because they were most anxious to get the greatest amount of work out of the installation that was practicable at the first possible moment. They had used the work incessantly for twelve months afterwards; they had made no complaint to the plaintiffs of bad workmanship or incapacity of the installation during that period. They had to discredit almost the whole of the servants in their employ, whose duty it was to supervise it while the work was being done, and the written and verbal reports these servants had made during its progress and on its completion. The existence of that evidence, of course, was known to me, as being among the admitted documents in the case. Yet the defendants now expect me to give greater credence to witnesses who are directly interested in discrediting the work of the plaintiffs, few of whom were familiar with the system on which the installation was based, and who know nothing about the treatment the work has been subjected to since it was completed. That the installation has not answered the expectations of the defendants I think is probable, though, as far as I can tell, they have made a very great saving in the cost of the gas produced by it as against their old installation. That many parts of the works on their demolition have shown serious faults has, I think, been proved; but considering that, before they were completed, the defendants' own engineers expressed their fear that the unfair treatment the works had received in the past they would receive from the Italian employees of the defendants' firm in the future, fully justifies me in saying that the defendants have failed to convince me that any of the injuries or signs of bad workmanship they gave evidence about were due to original bad construction by the plaintiffs; but I find they were caused by bad treatment and bad workmanship on the part of the defendants' employees, over whom it was practically impossible for the defendants to have proper or complete control, or to prevent them wilfully working the installation in such a way as to be injurious to the various portions of the work, and so to ensure that the new labour-saving appliances should not fulfil the results expected of them, in the hope that thereby more work would be provided for the men. The whole history of the case brings to light one of the most serious difficulties between capital and labour I have ever had to deal with; and it should be a warning to those who are legislating on trade disputes. The strike of the workmen in Italy is historical, and fights that took place between the strikers and the authorities, whether regal or municipal, is equally well known; and while the desirability of using labour-saving machinery as much as possible is so manifest, yet the certainty that its erection would be strenuously opposed, and would be injured when completed, is equally certain.

The defendants were, in fact, in this dilemma. They were under heavy penalties to the Municipality of Milan. The conduct of the Trade Unions in Milan made it almost impossible for them to carry out their contracts. The Chairman of the Company—Mr. Lucas—had been out there to endeavour to bring peace; but he considered himself, to use his own expression, lucky to get home again. The Company most naturally, therefore, looked to labour-saving machinery as there sheet anchor in the future; and they naturally and properly sent their most experienced engineers to see in action the best labour-saving machinery that had been introduced into any country. They went to Edinburgh and saw the plaintiffs' work there, which, according to the Chief Engineer in Edinburgh, is the most perfect and successful installation that has been erected; and they not unnaturally ordered it. But they

omitted one important element in their calculation. The installation was there worked by capable, skilled, and honest workmen, whereas at Milan they were certain to have incapable, unskilled, and dishonest workmen—men who, because they thought their daily bread would be taken from them by the introduction of this labour-saving machinery, felt themselves justified in wrecking it in every way they could.

What were the conditions under which the plaintiffs had to perform the work? They were these: Every Englishman they employed had to carry a revolver; every piece of work done had to be guarded; every bricklayer had to be paid £4 a week, besides food and lodging, whether he worked or was kept idle, in consequence of the bad workmanship of the Italians under them; many of them were stabbed while at their work; and work finished off or performed one day or night was constantly broken up directly afterwards. Take as an example the use of torches to fire the gas at certain stages in order to prevent explosions in the retorts—explosions which, according to all the reliable witnesses for the defendants, are injurious to the setting as distinguished from the retorts. These torches were provided over and over again; but as often as they were provided the men made away with them, so as not to be able to use them, until at last the defendants' manager gave up their use in despair and allowed the explosions to go on uninterruptedly for more than twelve months. In fact, I think I can best summarize the conditions under which the work was done by the plaintiffs, and under which the user of the installation was afterwards carried on by the defendants, according to the evidence of their own witnesses, by saying that, instead of its being properly called by such a heavenly name as San Celso, it was, as the Chairman of the defendant Company called it, Pandemonium—in other words, a hell upon earth.

Now, that being the position of the conditions under which the work was performed at Milan, notwithstanding these immense and almost superhuman difficulties that the plaintiffs had to contend with, the defendants' trusted and responsible servants, whose duty it was to supervise the work day by day and piece by piece, and to pass it when completed, wrote home the most satisfactory and complimentary account of the way the work was being carried out and had been completed. No words of greater praise were ever written of work performed by any contractors; and unless these servants were absolutely ignorant, incompetent, and, in fact, knaves, it is impossible that the bad state of the work, as depicted by the defendants' present witnesses as discovered by them in 1904, can be owing to original bad workmanship. That the defendants have felt all along how this evidence of their own engineers of good workmanship by the plaintiffs handicapped them in any claim they might make, is very evident; and they endeavoured to lessen its effect by either discrediting their servants, or denying the authority they claimed to have possessed to make the supervision for which they vouched at the time. In fact, unless I misunderstood Mr. Hamilton's early statement during the trial, he did not intend to call these witnesses; but, finding it necessary to do so, he endeavoured to discredit them in advance by saying that he only relied upon their evidence in a negative manner. What he meant by that I cannot say I do not know, because I thought I understood it at the time; but it certainly was a very strange remark to make.

Let me take as an example the evidence of the Chairman, Mr. Lucas. I was sorry to hear it. If true, it absolutely discredits the qualification of the Chairman and Directors for their position. But I am sure it was not true; and I can only account for his statement on the assumption that, having to sit in Court for fifteen days or so, he was so wearied and worried by the evidence and speeches of Counsel day by day that his mind had become a perfect blank to everything that had happened three years ago. I allude to his evidence more particularly. The question to him was: "The Board, I suppose, consists of gentlemen who are not technical gas manufacturers, and they have to take the advice of experts?" The answer was: "Quite so; and it was because we were not technical, in a great measure, that we trusted Messrs. Graham and Morton entirely, and placed ourselves entirely in their hands in the very difficult position we were in. . . . We put ourselves entirely in their hands; and that was the reason for there not being that strict supervision which usually takes place." Then another question: "From time to time Mr. Green is the Engineer whose assistance you avail yourselves of in technical matters?—(A) He has an office in the same office as that of the Board; comes into the Board-room, and very often receives verbal instructions." (Q) "Except so far as the Board gave him special instructions, did his office give him any authority to vary contracts that the Company had entered into?—(A) And without the knowledge of the Board? (Q) Knowledge and authority.—(A) Knowledge and consent, or authority. (Q) How do you describe Mr. Bourne's position at Milan? What was the name of his office?—(A) Mr. Bourne I should call the Engineer of the works—the gas maker of the works, to use my own phrase, but very generally called the Engineer of the works. He would be the Engineer of the works." Then he goes on and describes the position of Mr. Bourne and the servants there, and suggests that they had no authority to supervise these works. Now, it is absolutely incredible that anybody in the position of Mr. Lucas, with the knowledge that he and his Directors had, should have allowed work to be performed there hundreds of miles—thousands of miles—from home without anybody to see that the work was done properly by the Contractors. I never heard of such a suggestion being made in a Court of Justice, or in any other way, when we have the evidence of Mr. Green and of Mr. Bourne that they were there for the specific purpose of looking after the work; that it was their duty to do so; and that they were Engineers. Mr. Green was their Chief Engineer, and did not merely by chance come into the office occasionally and get verbal orders, but was their absolute Engineer—their Chief Engineer in the position that he claimed to have. Under these circumstances, it is idle for anyone in the position of the Chairman of the Company to say that they were so careless of their duty to their shareholders that they actually allowed work to the extent of £80,000 to be done without having anybody to look after it at all. Certainly, the statement is the greatest compliment which was paid to Mr. Graham, or Messrs. Graham and Morton, because it suggested that they had such a high reputation that it was not necessary even that defendants should have anybody to look after them. Both Mr. Bourne and Mr. Green have told us, as their reports in 1902 clearly indicated, that they did have authority to inspect and supervise the work, and they did so, and made their reports accordingly, and that those reports are true.

Against such evidence as this, how can I rely on that of such witnesses as M. Freyss and Mr. Marshall, both responsible for the demolition of the furnaces, and both anxious to justify that advice? But look at the extraordinary evidence of Mr. Marshall, as to his early connection with the Company. He is asked by defendants' Counsel if he did not receive £1000 a year to report on the installation, and to superintend its demolition and rebuilding, as this £1000 was a specific part of the damages alleged to have been sustained by the defendants. He said he did; but when he was cross-examined, it was discovered that his statement was entirely untrue. He had been paid nothing, and had no promise of anything, and had not made a claim for anything for reporting on this installation, which occupied him a considerable part of the month of April, 1904; and it turned out that £1000 a year was for superintending the whole of the works of the defendants at Milan, and had nothing specially to do with the demolition of the plaintiffs' work, unless my memory fails me as to the contents of this agreement, which was only hastily referred to during the trial. When asked why he had not been paid for reporting, or made any claim for it, he said he was too bashful and too diffident to do it. What rubbish! A labourer is worthy of his hire; and if Mr. Marshall is as able a man as I am willing to believe him, there must be some other arrangement by which, indirectly at any rate, he is to be remunerated for his services, but of which we know nothing. When you come to the evidence of Mr. Woodall, another of the defendants' witnesses, I admit that it is evidence of a different class and character; and he impressed me a good deal. He differs entirely from Mr. Marshall in some important points, and he had spoken most favourably of the plaintiffs' work while in progress. I think, therefore, in trying to support the defendants, he had not given sufficient weight to the disadvantageous circumstances under which the installation had been worked after it was completed by the plaintiffs.

One great cause of complaint was that the fuel bed was too thin, and witnesses said it should be nothing less than from 3 ft. 6 in. to 4 ft. or 5 ft., and that charging every two hours was most injurious. But by other evidence of the defendants we find that many beds are now only 2 feet or less; and that the whole of the London installations are charged every two hours—the facts being that a Milan stoker only does about one-third of the work of a London stoker, and therefore frequent stoking is a disadvantage to them. Then, again, as to the quality of the coal used, the defendants say the installation would not carbonize according to contract. The contract was to carbonize dry coal. But the evidence shows that the coal was often so wet that it was like being under a shower-bath of black water to be under the coal-shoots; and that in consequence of this water, the construction of the shoots had to be altered. In another place it is said by the defendants' Engineer (Mr. Green) that in May, 1903, on one day the coal is all dust, and on another day like mortar; and then the description of the cartage of the coal from the ship at Genoa to the works at Milan shows under what terrible disadvantages the defendants were carrying on their work, and how unfair it has been to the plaintiffs to put down to their fault the imperfect results they have obtained from the work done by their installation. M. Freyss denied that the coal was bad or caused bad working. But let me read what the Engineer said when the work was under his own control. I have two reports before me here—there were many others. In February, March, and May, I have specimens of reports signed by Mr. Bourne, signed by M. Solange, and actually signed by M. Freyss himself, after he said that the coal was never bad. I take first the one made in February—that was before M. Freyss apparently had displaced Mr. Bourne. It is signed by Mr. Bourne, who describes himself as the Engineer-in-Chief, and by M. Solange, who describes himself as a Director. What is it that they say there? They were obliged to employ boghead because of the bad quality of the coal received. Then in March and April, in a report signed by M. Freyss himself, who has denied here that the coal was bad, or calculated to bring about bad results, he says again: "These results are bad because of the bad coal, which spoils the installation." Then again in May you have exactly the same thing signed by M. Freyss and M. Solange; and yet after that he comes here and says the coal was not bad, and that it was an average quality of coal.

On these various points I should like to have referred to a few passages in the evidence; but I think really it is unnecessary that I should go very fully into it. I was going to refer to the effect of suddenly changing from six-hour to five-hour charges. It was done by Mr. Bourne because he could not help himself. They were so hard up for gas that they were obliged to do everything they could to force the installation before it was fit to be forced. What do the employees of the plaintiffs say at the time they heard of it? Done without their authority—done without their knowledge; they only discovered it when they found the installation did not bring about the results that were expected; and when they inquired of Mr. Bourne, he could not help himself. He was very sorry, but he was obliged to do it in order to get more gas. How can it be said, therefore, that the working of the installation by the defendants had nothing to do with the faulty character of the coal? These works are of such a scientific character that it is impossible to say what injury may be done from a particular piece of bad workmanship. It is all owing to the draught, and all owing to the use, and the improper use, of the dampers. If they are improperly used for only a few days, the whole value of the work may be destroyed; and so it is with reference to almost every part of this marvellous work which had been erected under the circumstances I have named. I must not omit to refer especially to the dampers and their proper use. It is admitted that the whole success of the installation depends on the right use of those dampers to regulate the draught; yet it is also proved up to the hilt that they were almost invariably used by the workmen in an improper way, and that by occasional improper using you may get fusing of the internal workings of a most serious kind.

I have said nothing as to the fact that this installation is founded on

the installations in Edinburgh and Leeds, where it works properly, and to the still more important facts that Mr. Herring, with the great experience he has had through life, and especially at the Edinburgh Gas-Works, and Mr. Hulse in the same position at Leeds, and a great number of witnesses of the highest eminence and reliability, all say positively that there is no inherent defect in the plaintiffs' installation, and that the signs of injury seen on the destruction of the furnaces were not due to bad original workmanship by the Contractors, but to bad working and foul play after the installation was completed. Their evidence, and the evidence of the other witnesses called by the plaintiffs, would compel me to arrive at that result; but as the onus is on the defendants of proving their case, as I said before, and the evidence of their witnesses is so unreliable and inconsistent with their original reports, I think it unnecessary to go more fully into the evidence of the plaintiffs' witnesses.

I ought to add that a most material piece of evidence against the defendants' contention that it was necessary to demolish the whole of the benches is that Mr. Bourne—the most loyal and self-sacrificing servant that anyone ever employed, and who knew more about the benches than all the other defendants' witnesses put together, for he saw them building day by day, and had worked them for over twelve months—did not think it necessary to destroy them; and he had actually ordered materials to repair them when M. Freyss came upon the scene, who, with the assistance of another new broom in the person of Mr. Marshall, succeeded in ousting Mr. Bourne from his situation, and installing themselves in his place. Neither of them knew much, if anything, of the Graham system; but having persuaded the defendants to demolish the settings, it is not very difficult to understand why their evidence is so tinged with prejudice and so unreliable as I found it to be. And from the fact that when Mr. Bourne himself began to alter the furnaces early in 1903, from the Graham system to what has been called his own or the Bourne furnace, without in any way communicating with the plaintiffs, and used these altered furnaces for twelve months without any communication with them, it is self-evident that he never thought of attributing blame to the plaintiffs' work, but, I imagine, considered that the system was not suited for the men under him to work the installation satisfactorily, and so thought it quite unnecessary to complain to the plaintiffs of faultiness in their work. The defendants knew, of course, what was being done, and must have approved of Mr. Bourne's conduct.

After such conduct on the part of the defendants, how can I now say that they are entitled to damages at the hands of the plaintiffs? What are they to have damages for? Is it for faulty workmanship, faulty nostrils, faulty ducts, or faulty furnaces? In each of such parts of the installation, bad workmanship by the defendants' employees was, I am convinced, the primary cause of the injury or faultiness that showed itself when the benches were destroyed. How can I divide it? How can I attribute £5, or £10, or £100 to this or that portion of the damages? If, as the plaintiffs said, such injury as the defendants had alleged had been caused by their omission, a sum of about £500 would have enabled them to put it right, I might have deducted it from the plaintiffs' claim; and I should have done so if I was convinced that any specific injury could be primarily or at all traced to their faulty working. But as I cannot see where I can justly say that it was, I should not be justified in making any such deduction. I have no doubt if the defendants had communicated with the plaintiffs before they began to alter the furnaces, the plaintiffs would have met them not only fairly, but, as Mr. Green said they had done during its construction, most liberally, if not lavishly, as they thought more, according to him, of their reputation than their profit. And considering that the very heavy cost the plaintiffs must have been put to over this trial above what by our system of taxation they will be able to recover, I should be guilty of great injustice if, for the sake of salving the honour of the defendants, I had made any deduction from the plaintiffs' claim that I did not think the defendants had justified.

For these reasons, my judgment is for the plaintiffs on the claim and counterclaim, and with costs.

Mr. ISAACS said in a case of this kind, where a number of scientific witnesses had been called, unless an order was made by his Lordship, the costs which would be allowed to the plaintiffs were nothing like what would be commensurate with the expenses incurred. Realizing this fact, there was a special rule which provided that certain fees might be allowed in any case where, on special grounds, the Court might so order. In the case where a number of scientific witnesses were called, the Court had it in its discretion to order the costs on the higher scale. He therefore asked his Lordship to make an order for costs on that scale, so that they might be a little nearer the expenses which the plaintiffs had been forced to incur.

Mr. SPOKES submitted that there was no reason for costs to be given on the higher scale.

Justice GRANTHAM said such an order was only made in special cases, and he certainly thought this was one of a special character, where he was justified in making such an order. The costs would therefore be on the higher scale, as provided for in the order to which Mr. Isaacs had alluded.

This concluded the proceedings.

The Poplar Borough Council and the Commercial Gas Company.—At the Thames Police Court yesterday, the summons taken out by the above-named Council against the Commercial Gas Company, which was heard on the 3rd inst. (*ante*, p. 377), for failing to pay on demand the expenses of filling in ground and making good the pavement surface of parts of certain streets to the reasonable satisfaction of the Borough Surveyor, and on account of which the Magistrate (Mr. Mead) decided in favour of the Council, was again referred to. Mr. G. H. Young, on behalf of the Company, said that the amount arrived at as being due to the Council was £28 13s. 7d., together with an order of £7 7s. on account of costs. He also asked his Worship to state a case; and after handing up the necessary documents for inspection, said he would submit them to the other side. Mr. Mead assented.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Wednesday, May 10.

(*Before Mr. Justice* BIGHAM.)

United Gas Improvement Company v. Gordon—Question as to a Monazite Sand Contract.

This was an action—or rather a consolidation of two actions—claiming damages for breach of an agreement dated May 28, 1902.

Mr. RUFUS ISAACS, K.C., and Mr. R. NEWTON CRANE (instructed by Messrs. A. J. Greenop and Co.) appeared for the plaintiffs; Mr. MONTAGUE LUSH, K.C., Mr. CLAVELL SALTER, K.C., and Mr. BREMNER (instructed by Messrs. Armitage and Chapple) represented the defendant.

Mr. ISAACS, in opening the case, said he would first state the circumstances leading up to the agreement which formed the subject of the action, as the matter was by no means simple. The United Gas Improvement Company was an American concern with a capital of $40,000,000, owning a controlling interest in the American Welsbach Company. The defendant was an American gentleman, residing principally in London, who was the owner of the principal deposits of the mineral known as monazite sand, which was found in certain parts of two provinces of Brazil, and also, to some extent, in Carolina. He had no interest in the deposit in Carolina; but he owned either land or concessions with regard to all the deposits in the two provinces, and he had the sole right to remove the sand, from which was derived a product called oxide of thorium, which in solution became nitrate of thorium—a very important, if not the most important, element in the manufacture of gas-mantles. It appeared that there were four German firms of manufacturing chemists who formed a kind of Syndicate or combination with reference to nitrate of thorium, and who extracted the nitrate from the sand, and then sold it to the people who manufactured the mantles. Mr. Mason, the President of the Welsbach Company of Philadelphia, was also considerably interested in the plaintiff Company; and, as representing that concern, he came to England in 1902 for the purpose of arriving at an arrangement with the German manufacturing chemists with reference to the nitrate of thorium. One of the great difficulties which manufacturers of mantles had to meet was the infringement of their patents by unsubstantial persons; the result of which was that, in many cases, by the time an action was brought and an injunction obtained ready to be served, the infringer had disappeared, and frequently started under another name in a different locality and continued the manufacture of infringing mantles. The idea was therefore suggested that if persons of this description could not get hold of the nitrate of thorium, it would be more difficult for them to carry on their business, and be a protection to all the legitimate manufacturers. With this object, Mr. Mason came to England and saw Mr. Deussen, the agent of Mr. Gordon at Hamburg, and the consignee of the monazite sand from Brazil, who distributed it according to the contracts Mr. Gordon had made. Mr. Mason had a conversation with the defendant and Mr. Deussen with regard to controlling the supply of nitrate of thorium; and, among other things, he asked what was the position of the existing contracts. Mr. Gordon said they were all nearly run out, and that, pending negotiations with the plaintiffs, he would not make any fresh ones. At that same interview, Mr. Mason took an option on behalf of the Welsbach Company of Philadelphia to purchase, for four years ending 1906, 256 tons of sand per annum, making 1000 tons, at a certain price. This quantity was afterwards delivered, and formed the subject of a contract which was not in controversy; the option being, in fact, exercised on April 17, 1902 It provided for the price, and that the sand should contain not less than 5 per cent. of thorium oxide. During the continuance of this comtract, the defendant was not to export or supply monazite sand to any person in the United States other than the Welsbach Company, and so on. This option having been exercised, Mr. Mason went to Germany and commenced negotiations with the firms there, who asked for certain concessions from his Company; and it was arranged that they were to meet again. Mr. Mason remained at his hotel expecting a summons to attend this meeting; but it did not come. Eventually he went to the house of one of the manufacturers, and there found that they had already met, and there appeared to be some embarrassment at his appearance. It afterwards turned out that a contract had been arranged which left him out altogether, and which was, in his view, contrary to the good faith which he had a right to expect from those firms and from the defendant. Under this contract, the defendant bound himself to supply these German firms for five years on certain terms. Mr. Mason objected strongly, and did all he could to prevent the contract, which had been made by Mr. Deussen, being confirmed by the defendant. It was dated the 12th of April; but it was not signed until some days after—the earliest signature being on the 26th, and the last on the 30th. Under this contract, the defendant agreed to supply the requirements of the four German manufacturers for the succeeding five years, up to June 30, 1907, at certain named prices; and during the continuance of the agreement, which both parties undertook to keep secret, he was not to deliver monazite sand to any firm or persons, except under special contracts named, the last of which was the one with the Philadelphia Company for the 1000 tons entered into on April 17, 1902. On the other hand, the German chemists undertook not to buy sand from any other quarter, nor to sell it to other parties, without defendant's consent, and to give him an interest, as from July 1, 1903, in their profits from the manufacture of thorium. It was this profit which formed one of the items in the plaintiffs' claim for damages. If the defendant broke the agreement, and wrongfully sold monazite sand containing thorium in breach of it, he was to pay a certain fixed penalty of 1000 marks for every ton so sold; and in the event of his selling or assigning his interest in the sand, he was to impose on the purchaser all the obligations of the agreement. The effect of this was to give the German Syndicate, as he might term them,

the whole of their further requirements for five years. One of the points he would have to submit was that this meant all requirements for the purpose of manufacture, and did not entitle them to ask for delivery of such quantities as they might need for the purpose of keeping in stock in view of an anticipated rise in the market. Mr. Mason had some further meetings with the German chemists, but nothing resulted; and he then returned to London, when negotiations went on between him and the defendant, which culminated in the agreement of May 28, 1902. The learned Counsel then went through this document (a very long one), the principal points of which were as follows: It recited that the defendant was the owner in fee of certain lands and concessions in Brazil containing the monazite sand; that he had entered into contracts with certain parties for the sale of the sand, and that he now had in store at Hamburg 480 tons of refined sand; and that he was desirous of selling all his lands and the existing contracts, and of being relieved of the obligations attending them. It was then agreed that the defendant was to sell, assign, and transfer to the United Gas Improvement Company, in consideration of £25,000 sterling then paid, all the lands and concessions and monazite contracts as from May 28, 1902, according to an annexed inventory, for a sum of £275,000—£25,000 to be paid on the execution of the agreement, and the balance (£250,000) on or before Feb. 1, 1904; and that, on such payment, he was to deliver over all proper deeds and conveyances. Upon his failure so to do, the time for payment of the balance of the £250,000 might be extended until they were delivered. If he should fail to deliver a clear title before Feb. 1, 1905, the plaintiff Company were to have the right to withdraw from the purchase on giving written notice. On the other hand, should the Company fail to complete the payment of the purchase-money, the defendant was to be relieved of all obligations under the agreement, and the contracts were to revert to him, except that entered into with the Welsbach Company, dated May 17. Until the payment of the balance of the price, the defendant was to remain in possession of all the lands and concessions, but on condition that, during the continuance of the agreement, he should not remove or export monazite sand, or allow it to be exported, to any party other than the plaintiffs. Then there was a covenant by him that he would deliver refined monazite sand in such amounts, not exceeding 800 tons in any one year, to be shipped as the plaintiffs might direct, and within six months after receipt of their orders. There was a stipulation as to the quality—that it should contain not less than 5 per cent. of thorium oxide—and it was to be delivered c.i.f. at Hamburg. The allegation was that there had been a breach of both these covenants.

Justice BIGHAM asked if the case set up was that the defendant had been working on his own account, and had neglected to execute the plaintiffs' orders.

Mr. ISAACS said it was; there was no doubt about it. He believed that the only question would be whether what defendant had done was, under all the circumstances, justified. There were conditions in the agreement as to the payment of £22 per ton by the plaintiffs, which sum was to be taken on account of the purchase-money if the agreement was carried out, less the working expenses. In the event of the plaintiffs' not completing the purchase, they were to have the right of tendering back the whole or any part of the monazite sand they had received. There was also provision that if the defendant did not get orders to the amount of 600 tons in any one year from the plaintiffs, he should have the right to export sufficient to make up that amount on his own account, because he was under an obligation, under one of his concessions, to export this quantity annually. Then it was agreed that the plaintiffs might, by notice before Feb. 1, 1904, elect not to complete the purchase, in which event they were under no obligation to pay any part of the balance of the purchase-money. The defendant having assigned all the contracts he had for the delivery of monazite, the plaintiff Company assumed all the obligations and stipulations of the contracts, and agreed to indemnify defendant in respect thereof; and the plaintiffs were to give a bond in the sum of £10,000 providing for the due fulfilment of the indemnity. Lastly, there was a provision by which the parties agreed to submit any question arising on the contract to the jurisdiction of the English Courts. Appended to this agreement was a list of the unfulfilled contracts, including the one dated the 12th of April with the Welsbach Company, and another with the Austrian Incandescent Gas Company of December, 1900, under which a portion of the sand remained to be delivered. The substance of the plaintiffs' complaint was that Mr. Gordon had sold and delivered quantities of monazite against the plaintiffs' instructions, and in defiance of them, and had refused to deliver according to the instructions they gave. With regard to this, he would first put in the admissions by the defendant. The principal points were as follows: He admitted the agreement, and that the plaintiffs paid the £25,000 on its execution; he had admitted that he had made certain shipments of monazite sand from Brazil, one of which was of 413 bags by the *Petropolis*, which arrived about March 17, 1903 (that would be an important date). He then went through a number of other shipments, making altogether 3281 tons, and admitted that he had, under the circumstances mentioned, delivered monazite to persons other than the plaintiffs; also that Mr. Deussen had delivered to various persons mentioned part of 780 tons lying at Hamburg against the plaintiffs' instruction. He thought there could be no doubt that Mr. Deussen had no right to do this; and the question raised was whether by doing it he had acted as agent for the defendant. He admitted the delivery of monazite under the contract of the 12th of April; and except so far as appeared by the correspondence, he made no request to the plaintiffs to furnish a bond for £10,000. Lastly, he acknowledged that he had participated in the profit made by the German firms, and had received certain money in respect thereof. Proceeding, Counsel said that after this contract had been made, things went on satisfactorily for some time, and then a question was raised in this way: The German manufacturing chemists wanted to stock monazite sand, in order that they might get the benefit of any rise of price that was anticipated. The object of this agreement was to control the supply of the material except so far as was immediately necessary for the purpose of manufacture. The position Mr. Mason took was that he was liable to indemnify the defendant from any damage he might suffer in consequence of alleged breach of contract with the German Syndicate; that he was ready to supply them with what they wanted for the purpose of their manufacture; but that they were not entitled to have more than this, and that, at any rate, he was entitled to raise the point. The contract was one which, under the agreement, was assigned to the plaintiffs, who had to indemnify the defendant for any breach; and therefore he had no right to supply these chemists in Germany against the plaintiffs' orders. There seemed to have been a struggle between the Syndicate and the plaintiffs as to who was to get the control of the supply; and Mr. Deussen, who had represented the defendant for a considerable time, clearly took the view of the German firms that they ought to be served, and that it was against the defendants' interest that they should not, as it certainly was, and it was also against Mr. Deussen's interest, because he might have actions brought against him, which he did not want. Mr. Mason said this had nothing to do with him. There was the indemnity, and the defendant had no right to supply monazite except with the plaintiffs' consent. For some time the defendant held the view that he had not the right—that he must carry out strictly the contract that he had made; and Mr. Mason gave him notice that he would be rendering himself liable to serious consequences if he broke it. But, under pressure put upon him from Germany, the defendant seemed to have given way to Mr. Deussen's views, and to have delivered 3281 tons. Whatever question there might be as to the quantity, he certainly did supply persons whose contracts had been assigned to the plaintiffs, as they said, in breach of the agreement. As he understood, the defence set up to this was that the defendant had entered into a contract with these persons to supply them, and was entitled to do so notwithstanding that he had otherwise agreed. One of the defences raised was that as the plaintiffs were bound to supply, the defendant was entitled to do it for them. The result was that the defendant got the profit instead of the plaintiffs. He (Counsel) could not see any defence to this. It was also said that on Feb. 1, 1904, which was the date for the decision by the plaintiffs as to whether or not they would go on with the purchase and complete it, they determined not to proceed with it; and he agreed that they did that in writing. But this could not affect the rights which had accrued between 1902 and Feb. 1, 1904, under the agreement. Beyond that, they said the defendant refused to recognize the legality or obligations of the contract, or any of them, and therefore they were entitled to carry them out themselves. Counsel then referred to the points of defence pleaded, and said that the real issue raised seemed to be whether the defendant was entitled to say: If you do not supply these people, I must do so.

Justice BIGHAM: You say that you were entitled to deal with these contracts as you pleased—to break them if you liked; and, if you did, and so made the defendant liable for damages, he must look to you to be recouped under the indemnity.

Mr. ISAACS said that was his contention. Even supposing they did refuse to recognize the legality in the sense that they refused to perform the contracts, then, before any question arose, or anybody had any right of action, they had formally given notice that they were ready to do it. In fact, the first ship, the *Metropolis*, arrived after the plaintiffs had given notice that they were ready to make delivery. A further defence was that if the defendant had made any sales to any persons other than the plaintiffs, such sales were effected under, and in pursuance of, verbal authority given to Mr. Deussen. This was a question of fact which would have to be proved. Lastly, the defendant said the plaintiffs had elected not to complete the purchase, and that any claims against him were at an end. He also contended that they had not given the bond for which provision was made. In the contract of the 12th of April between the German firms and the defendant, there was a provision for £50 liquidated damages; and in the contract of the 28th of May there was also a provision for the payment of liquidated damages at £50 per ton. Under the agreement, a bond for £10,000 was to be given, to be signed by one of four named bankers or else someone approved by the defendant. He admitted that he never asked for it; but the point was now raised, as he understood that the £50 liquidated damages was only to be paid to the plaintiffs if they faithfully performed all the obligations under the agreement. It was now said that they could not recover these liquidated damages because they had not faithfully kept and performed the covenants, as they had not given this bond. He should submit, first of all, that giving the bond was not a condition precedent to the plaintiffs' rights; and that in the events which had happened the defendant had waived his right to treat that as a condition precedent to the plaintiffs' right to recover damages.

Justice BIGHAM remarked that, supposing this clause did take away the right to the liquidated damages specified, it would not destroy the right to general damages, if any.

Mr. BREMNER assented to this suggestion.

Mr. ISAACS said he wanted, if possible, to support that claim to £50 per ton, because it would so greatly simplify the calculation of damages. The facts with regard to the bond were very simple. From the time the contract was entered into till after the bringing of the first action in May, 1903, no question was ever raised by anybody about the bond; but when the first action was commenced, and the plaintiffs claimed an injunction to restrain further breaches of the agreement, in the affidavits filed against the claim this point about the bond was raised for the first time. The matter came before his Lordship, who declined to interfere. But a limited undertaking was given, and subsequently a second action was commenced, because there were additional breaches; and the two actions were consolidated. In the meantime, the plaintiffs set to work to remedy the defect alleged about the bond; but not one of the banks named would undertake the business. The plaintiffs then offered to put £10,000 in Consols; and they got a form of bond from the Law Guarantee Society and sent it to the defendant's Solicitor, who approved it so far as he could. But the defendant was somewhere out of the country; and there the matter had stood up to the present time.

Justice BIGHAM said that at present this question of the bond looked like an afterthought.

Mr. ISAACS said the principal facts appeared by the correspondence, a great part of which he should have to read.

Thursday, May 11.

When the case was resumed this morning, Justice BIGHAM said he must ask Mr. Isaacs to state specifically what were the breaches of contract which he was going to prove.

Mr. ISAACS said he thought they were stated in the pleadings. They said the defendant had himself carried out the contracts which he had assigned to the plaintiffs; but he could not state the exact quantities of goods delivered, as no particulars had been furnished. In reply to further questions, he said one of his objects in reading the correspondence was to show that the plaintiffs objected to the defendant making the contract of May 12 with the four German firms.

Justice BIGHAM said he did not see that this was material.

Mr. ISAACS said it was to meet the point which would be raised against him that, the plaintiffs being unwilling to carry out these contracts, the defendant was entitled to do this himself. He submitted that the contracts were not enforceable against Mr. Gordon, and that he ought to have refused to carry them out, and to have relied on his indemnity. The object of Mr. Mason from the outset was to get control of the market; and this was defeated by the agreement with the German firms. He therefore objected to it, and was advised that it was too vague to be enforceable, besides which it was unilateral. He did not say this was the right view, but it was a question of German law, and that was the advice Mr. Mason received; and he said he was entitled to raise this point, or any other defence he might be advised. After a time, as would appear by the correspondence, this view was abandoned, and notice was given that the plaintiffs would carry out the contract (which had been assigned to them) through Deussen. Then a further point was raised, that the German firms were calling for larger deliveries than were necessary to meet their "requirements;" his contention being that this only meant manufacturing—not speculative—requirements. The learned Counsel then proceeded to read extracts from the very bulky correspondence, showing a gradually increasing state of friction arising between the plaintiffs and Deussen, at Hamburg, with regard to carrying out the agreement with the German firms. Deussen had become the agent of the plaintiffs; but he was really acting in the interest of the defendant. The object of the plaintiffs was evidently to keep down the supply in Hamburg; while Deussen, on the contrary, was continually pressing for shipments to be sent forward, so as to keep up the stock. Towards the end of 1902, directions were given to ship the sand to Rotterdam instead of Hamburg, with the object, as was suggested, of keeping it outside the jurisdiction of the German Courts. To this Deussen objected, as it might involve him in lawsuits. He therefore declined to obey plaintiffs' instructions in certain respects. A long letter of Dec. 31, 1902, from Mr. Mason to the defendant was read, in which the writer plainly stated that he did not consider the contract with the German firms was binding, and requesting the defendant to find some other consignee for the sand, as Deussen was refusing to obey plaintiffs' instructions. A copy of this was sent to Deussen. The defendant replied promising to do all he could to meet plaintiffs' wishes, but urging strongly the necessity of not breaking with the German firms, at any rate until he had completed arrangements for a further concession in Brazil, for which he was then negotiating. On Jan. 3, 1903, Mr. Mason wrote to Deussen repudiating the validity of the contract with the German firms, but offering to supply sand to Deussen himself on the same terms; the object being to prevent any hostile action on the part of the firms, but at the same time to avoid recognizing the contract. On Feb. 2, 1903, there was an interview between Mr. Mason and the defendant, who stated that he would be so seriously embarrassed in Brazil, if difficulties arose with the German firms, that, rather than stop deliveries, he would make them himself, even if he had to pay the penalty of £50 a ton provided by the contract. Mr. Mason said it must not be assumed that all deliveries were to the German firms; but he objected to their having as much as they pleased. It was then decided that the German firms should be informed of the contract of May 28, and shortly afterwards a meeting was arranged in London between the defendant, Mason, and Deussen, and an endeavour was made to find a *modus vivendi;* but ineffectually. Soon after that several letters were written by Deussen to the defendant, in which he used very strong terms about Mr. Mason, and said he was going to deliver the sand to the German firms, from the cargo of the *Petropolis* and *San Paulo*, which had then arrived. On March 25, there was a letter which plaintiffs relied on as a breach of the contract, in which the defendant, writing to Deussen, instructed him to telegraph to plaintiffs for permission to deliver, and if such permission was not received within 48 hours, to deliver on his (defendant's) account. On the same day the members of the German Syndicate were officially notified of the contract of May 28. They were then claiming the whole of the two cargoes which had arrived. About this time, the Solicitors on each side began to intervene, and soon afterwards the writ in the first action was issued. After that there was further correspondence, much of which bore upon the question of the bond. Then at the beginning of 1904 the plaintiffs gave notice that they would not complete the purchase.

Justice BIGHAM asked what was the financial position between the parties.

Mr. ISAACS said plaintiffs had paid £25,000, but that this was taken on account of the sand.

EVIDENCE CALLED.

Mr. *Sidney Mason* was then called. He said he resided in Philadelphia, and was President of the Welsbach Company of the United States. The plaintiff Company owned controlling interest in that Company. Its capital was $40,000,000, or £8,000,000 sterling; the shares were $50; and the market price was $120. They did a very large business in America. In 1902, the incandescent mantle business was in a very demoralized condition, and anyone with very small capital could set up the manufacture. He came to Europe early in that year, with the view of trying to make some arrangement for controlling the market in thorium.

Justice BIGHAM: To create a Trust?

Witness said that depended on what was meant by a Trust. His object was to benefit the United Gas Improvement Company and its connections, especially the Welsbach Company of America. He then went on to describe his interviews with Mr. Gordon, in London, which took place after he had been to Germany, and made the first contract on behalf of the Welsbach Company for 1000 tons of sand. He knew that defendant was under contracts with other parties, but had no particulars; and he was told by the defendant that they would all shortly expire. At an interview with Gordon at the Carlton Hotel, Mr. Deussen, who was present, told him of the contract he had made with the German firms. At witness's request, defendant instructed Deussen to return to Hamburg and fetch it, and it was handed to witness within a week. This was a month before the contract now sued upon was signed. Defendant seemed surprised at the German contract, and witness pointed out that it was not signed by anyone on defendant's behalf, and thought defendant ought not to ratify it. But he said he must support anything Mr. Deussen had done. He (witness) had never seen or heard of any other copy than the one handed to him, which had been in his possession since, and it was attached to the contract of May 28. Soon afterwards, Mr. J. R. Bennett, the Counsel to the Welsbach Company, arrived in England with a full power of attorney from the plaintiff Company, and executed the contract of May 28 on their behalf. He pointed out that the contract with the German firms was very embarrassing, and expressed a doubt as to its validity. He afterwards took the opinion of a German lawyer upon it, which was to the effect that if it was certain in its terms the absence of Mr. Gordon's signature would not affect it. Witness then described the interviews with the defendant and Deussen in February, 1903, when he pointed out how important it was, in negotiating with the German makers, that the stock of sand in their hands should be kept low. The whole situation was discussed, and he pointed out the difficulty created by Deussen refusing to transfer the stock to Rotterdam. Deussen, on the other hand, spoke of the difficulties he would be placed in by not keeping faith with the German firms; and he said that if the matter was explained to his principals he believed they would consent to deliveries being made. Deussen, however, must give an undertaking not to exceed the authority granted him; and he suggested that Deussen should state in writing what he was willing to do. The next day Deussen handed him the letter of February 6, which was not what he wanted, and he told him so. He never authorized Deussen to deliver 1000 tons, or any other quantity, of sand under the German contract. The value of it was 600 marks (£30) per ton of 1000 kilos. The plaintiffs were to have half the profit on the sale of the thorium. A ton of sand would yield about 83 kilos. of nitrate of thorium, on which the profit would be 12 marks per kilogramme; the price at that time being 40 marks. The price of thorium in Germany at Midsummer, 1902, was 30 marks; in January, 1903, it was made 40 marks; and it subsequently advanced to 50 marks—the present figure. The price was made by the Syndicate, as they practically controlled the output. He knew of no other manufactory of any importance except one in Vienna. The plaintiff Company manufactured thorium in America, and also mantles; their output was about 50 or 55 per cent. of the total. The price was controlled by the German Syndicate. After January, 1903, the defendant had not made any delivery or tender of sand to the plaintiffs except 115 tons.

Cross-examined: Mr. Bennett suggested the transfer of the stock to Rotterdam, as a protection in case any action were taken by the German firms. The plaintiff Company did not decide not to carry out the contract with those firms, nor that they would; they reserved their right to question its validity. Deliveries of sand could have been made from Rotterdam.

By Justice BIGHAM: The plaintiff Company kept a minute-book in America. It contained no references to this transaction, beyond a ratification of the contract. There were twelve Directors, who met monthly; but he was not one of them. He did not hold any position in the plaintiff Company, and had no authority from them when he came over in 1902. At these interviews he simply acted as their representative, under a verbal authority from the General Manager, who did not tell him what he was to do. He came over solely on behalf of the American Welsbach Company, which was the offspring of the plaintiff Company, with the view of bringing about an agreement between the German firms, Mr. Gordon, and the American Company. Nothing came of it; and he then cabled for Mr. Bennett to come over with a power of attorney from the plaintiff Company. His object was to effect a purchase which would have necessitated having at hand some £300,000, which was more than the Welsbach Company could command. For the same reason, the contract of May 28 was made on behalf of the plaintiff Company, though it was entirely in the interest of the Welsbach Company, in which the plaintiffs had the controlling interest. The capital of the Welsbach Company was $3,500,000; but it was considerably watered, as there had been several reconstructions. They paid dividends. All the letters he had written on behalf of the plaintiff Company in this matter were approved by the General Manager of the Company before they were signed. The copies were in his private office of the Welsbach Company, which was in the building of the plaintiff Company.

Friday, May 12.

Mr. *Mason* was further cross-examined at some length to-day as to the various interviews. He said Mr. Bennett more than once expressed the opinion to the defendant and his Solicitors that the contract of April 12 with the German firms was invalid. The defendant insisted at first that it must be carried out; but he afterwards receded from this position, when witness said it would defeat the object of the contract then being negotiated, if plaintiffs covenanted to carry out the German contract, as defendant suggested. When the contract was signed, he had not formed any intention whether the German contracts should be carried out or not; and Gordon understood that it was left an open question. On this footing, the bond for £10,000 as security was offered and accepted. After a great deal of pressure, the witness admitted that if the German firms were entitled to have their contract carried out, it was a dishonourable act to repudiate it in order to put pressure upon them. In March, 1903, the opinion of a German lawyer was obtained as to the validity of the German contract. It was in writing, and was now in his possession.

Justice BIGHAM said it had better be sent for; in the meantime the witness could state the effect of it.

Witness said there were several points, but the result was that he thought it would not be wise to question the validity of the contract. Mr. Gordon suggested that the German firms should not be informed of the contract now in question.

The cross-examination of the witness was continued throughout the day; ranging over the whole of the period concerned, and directed principally to ascertaining the attitude taken up by the witness at various times as to carrying out or repudiating the contract with the four German firms. His answers were not always consistent with each other, and at one time elicited comment from his Lordship. The witness was still under cross-examination when the case was adjourned till yesterday (Monday).

GUILDHALL JUSTICE ROOM.—Thursday, May 11.

(*Before Alderman Sir* JOHN BELL.)

Star Inverted Incandescent Burner Company, Limited, v. Norden.

Charge of Selling Goods Bearing a False Trade Description.

Summonses Withdrawn on Agreed Terms.

The adjourned hearing was fixed for to-day of the two summonses taken out by Mr. Harry Maisner, the Managing-Director of the Star Inverted Incandescent Burner Company, against Mr. Julius Norden, of the United Chemical Works. The first was for having on March 28 unlawfully sold certain goods—inverted incandescent mantles—to which a false trade description was applied; and the second for having such goods in his possession on April 1. At the earlier hearing, on April 13, the second summons (which it was agreed should be taken first) was partly gone into, as reported in the "JOURNAL" for the 25th ult., p. 242. When the case was called on this morning, it was announced that the parties had arrived at an agreement.

Mr. BODKIN appeared on behalf of the Star Burner Company; Mr. HORACE AVORY, K.C., and Mr. BIRON represented Mr. Norden.

Mr. BODKIN said that since the case was last before the Magistrate, the defendant had put before the prosecutors certain matters as to which he would like to say a word. The prosecution was under the Merchandise Marks Act; and the object of it was that the Star Inverted Incandescent Burner Company should be protected with regard to what was unquestionably their property, and that no imitations or infringements of the patent or registration rights which the Company possessed should be permitted. The defendant having put explanations before the prosecution, and having expressed his regret that he should have sold the mantles which were alleged to be, and were proved to be, infringements of the Star Company's rights, had met the summonses in a perfectly right and proper way, if he might say so. Therefore, he having taken this proper and straightforward course—having expressed his regret, and undertaken not to sell any more of these two-clip mantles in contravention of the rights of the Star Company—and having indemnified the prosecution in the expenses to which they had been put in making clear their rights, the Star Company desired, with the permission of the Magistrate, to withdraw the charges. They accepted the explanation which the defendant had given, that his dealing in the infringements of the Star Company's property had been due to inadvertence on his part. They thought that there was not here any deliberate infringement for the purpose of making an illicit profit out of the transactions, and that there was reason for saying that (to use the language of the Merchandise Marks Act) defendant had "acted innocently," in the sense of not intending in any way deliberately to make such illicit profit. The defendant had further shown that he desired to make every possible amend for his conduct by allowing the Star Company, in their discretion, and within certain agreed limits, to make public the fact that he had apologized, and had given an undertaking not to deal in this way in the future. In view of these matters, which were recorded in correspondence between the parties, the Star Company desired to say that, the aim of the prosecution having been gained, there seemed to be no further object in going on for the purpose of endeavouring to obtain a conviction against a gentleman who had met the matter so frankly and fairly as the defendant had. He therefore had to ask that the summonses should be withdrawn. It had been agreed that the mantles seized should be destroyed, if this course met with the approval of the Magistrate.

Mr. BIRON said he was obliged to Mr. Bodkin for putting the matter so fairly before the Court. He had nothing to add except that it would be remembered that directly the subject was brought to Mr. Norden's attention, without any demand for information being made, he voluntarily gave the fullest particulars as to where the mantles had been obtained, and stated what he had done in the matter.

The MAGISTRATE, in assenting to the withdrawal of the summonses, said he remembered at the first hearing making some comment about the correspondence that had passed between the parties. It was so highly creditable that he thought at the time there would be some reasonable way out of the trouble.

Mr. BODKIN: And you approve of the destruction of the mantles?

The MAGISTRATE: Certainly.

Gas Charges at Bradford.—On the minutes of the Gas Committee coming up for consideration by the Bradford City Council, Mr. Palin mentioned that a large proportion of the ratepayers of Bradford Moor were paying 4d. per 1000 cubic feet more for gas than other parts of the city. He asked whether the Gas Committee would consider the advisability of making arrangements similar to those existing in the case of Tong, by which the price would be reduced to the ordinary city level. Alderman Hind, the Chairman of the Committee, replied that all had been done by the Gas Committee that could be done for the benefit of Bradford Moor and Thornbury. It was a question now for the Finance Committee.

MISCELLANEOUS NEWS.

THE PUBLIC LIGHTING QUESTION IN NEW YORK.

The Legislative Investigation.

Continuing from last week (p. 380) our summary of the proceedings at the above inquiry, we reach the business which engaged the attention of the Committee on the ninth day. It related mainly to the Edison Company's affairs. It was admitted that the city lighting contracts are the most remunerative that the Company have. According to the highest estimate, the cost of each of the arc lamps in Manhattan is $124·13, or at the rate of 4·6 c. per kilowatt-hour, whereas the city is charged at the rate of 5·4 c. In the Bronx, where the lighting is on an overhead, and consequently less costly, system, the difference between the cost to the Company and the rate the city is charged is even greater. Mr. A. Williams, who has charge of the contracts, gave evidence to the effect that 937,189 kilowatt-hours were supplied to the city for lighting public buildings at 11·36 c., per kilowatt-hour; and that of the total, 670,138 kilowatt-hours had been charged for at the rate of 12 c., amounting to $80,416. He said the city was a very poor customer, especially for school lighting. The Company had a customer in a single building who used more current than the city did in 1899. If the service and installation could be the same, which they could not, the city would be charged $35,000, instead of $80,000, for the year's service.

The Mutual Gaslight Company, who are not allowed by their Charter to combine with any other lighting company, but whose stock is controlled by the Consolidated Company, came in for a share of attention. Though the Company are supposed to divide among the consumers all profits exceeding 10 per cent. per annum, it was shown that this had proved to be only in theory. Mr. J. S. Sanborn, the Vice-President of the Company, was the witness from whom this information was extracted. The Company's report to the Tax Commissioners, on June 30, 1904, was read, showing a surplus added to the reserve fund and a dividend paid of 9 per cent. Mr. Hughes (the Counsel for the Committee) read from the Charter of the Company, which provides that when the profits exceed 10 per cent., the excess shall be divided among the consumers; and he asked Mr. Sanborn if any such division had ever been had. "No, Sir," the witness replied, "any excess earnings have been used in developing the system. Our dividends for the last ten years have averaged only 8 per cent." Witness was then asked to give the amount of the earnings in excess of the expenses for 1904, not including the sum of $140,630 set aside that year for depreciation and $210,000 written off for the "scrapping of four holders;" and his answer was $632,233. When Mr. Hughes asked what 10 per cent. on the capital stock for one year would be, witness replied $343,233. Going back over the four years, it came out that the Company had never divided their excess earnings among the consumers and stockholders, as their Charter provided in certain contingencies, but that instead a reserve surplus amounting to more than $878,000 had been created. Mr. Sanborn explained that it was the intention of the Company's officials to rebuild practically all the plant out of the earnings. He said the reserve had already been expended in replacing old plant by modern machinery, and that between $700,000 and $800,000 more would be required to complete the rebuilding now contemplated. Mr. Sanborn was asked how he arrived at the sums set aside for depreciation; and he said he could not explain the system clearly. Whereupon Mr. Hughes said: "Now, as a matter of fact, do you not first find out how much money you have made, then what dividends you want to pay, and set aside the excess over dividends and expenses as a reserve fund for depreciation?" The witness fought for some time against answering the question; but he finally admitted that the assumption of Mr. Hughes was, in the main, correct.

In the course of the investigation into the affairs of the New Amsterdam Gas Company—one of the subsidiary undertakings—a curious state of things was disclosed. The Company is a combination of the East River Gas Company, the Carbide and Acetylene Company, and the Central Union, Northern Union, and Equitable Gas Companies. It was shown that the franchise of the Equitable Company will expire in seven years, while those of the Central Union and Northern Union have actually been dead for 26 years. It was shown that the Acetylene Company had neither plant nor anything else, except a patent which the New Amsterdam Company has never used, though it figures among the assets of the Company for $7,000,000. This great structure of defunct or expiring franchises has been built up into a stupendous concern, the capitalization of which is $37,000,000. These facts were ascertained with some difficulty; but the truth came out at last through Mr. G. W. Doane, the Vice-President and General Manager of the Company. Against the $37,000,000 claimed as the value of the New Amsterdam Company, Mr. Hughes put the tax statement of $12,000,000; leaving $25,000,000 to be accounted for. Addressing the witness, he said: "You have sworn that this $12,000,000 is the real value of the property. Are you able to state what the remaining $25,000,000 stand for?" "For the mains, meters, and other property, including franchises and goodwill," replied Mr. Doane. "Then is $12,000,000 the real value of the property?" asked Mr. Hughes. "These are not the real values at all in these tax statements; they are just values for purposes of taxation," replied the witness!

In answer to further questions by Mr. Hughes, Mr. Doane said the quantity of gas manufactured by the Federal Union Company in 1904 was 1,010,199,700 cubic feet, for which a sum of $1,024,237 was received. The Federal Company manufactured 413,704,000 cubic feet of gas for the Northern Union Company under contract. At Mr. Hughes's request, the witness reviewed the contract, which was dated February, 1902. According to its terms, the Central Union Company guaranteed to furnish to the Northern Union Company at least 300 million feet of gas, for which they were to receive 10 per cent. in addition to the cost of manufacture. The Northern Company paid the Federal

Union Company $127,146, which included the 10 per cent. profit. Deducting this, the actual cost would be 34 c. They sold 27,764,700 cubic feet to the Consolidated Company, at the rate of 28 c., without deducting the 10 per cent.

Mr. Hughes then went into the history of the franchises of the Central Union and Northern Union Companies, reading from a report of the Department of Public Works, dated November, 1876. By this it was shown that the Central Union was the successor of the Westchester County Gas Company, who obtained their Charter in 1859 to expire in 1879. He asked the witness if the Central Union Company had ever paid dividends; and he said they had done so once, in 1902, when they declared one of 2½ per cent. He went on to say, in answer to further questions, that the capital stock of the Northern Union Company was $1,500,000, and the funded debt was $1,250,000. In the report made to the Tax Commissioners, the sum of $1,356,313 was given as the total gross assets, including real estate; but this was only true for purposes of taxation. The franchise value had since been marked up to $1,600,000. The Northern Union Company did not make gas, and they had only paid one dividend, of 4 per cent., in 1902. Before Mr. Doane left the chair, Mr. Mathewson put some questions to him for the purpose of bringing out in a more favourable light certain points in his testimony. He asked if it was not true that the plant of the Equitable Gas Company had been abandoned, and that the property had cost the stockholders a couple of millions more than the valuation of it. Mr. Doane answered in the affirmative. "Now, Mr. Doane," said Mr. Hughes, "did you answer that question because Mr. Mathewson led up to it, or do you know these facts of your own knowledge?" "I was giving Mr. Mathewson as my impression what I refused to give you as facts," answered Mr. Doane.

At this point, Mr. Whitely, the Treasurer of the Electric Light and Power Company, was recalled and questioned as to the capitalization and organization of the concern. As shown by the balance-sheet for 1904, the capital was $5,346,600, of which $1,649,500 was in preferred and $3 697,100 in ordinary stocks. The funded debt amounts to $5,095,000, of which $257,000 is now in the Company's treasury. Mr. Whitely explained that practically all the stocks and bonds were owned by the Consolidated Gas Company; and those other Companies figured in their books for $1,052,600. It came out that the report to the Tax Commissioners in January of this year showed values much less than those on the books of the Company. The total gross assets were given as $5,065,172, exclusive of franchise value and patent rights. The former was given as $1,521,600, the amount fixed by the State Board, and $1,000,000 was the sum paid for the patent licence of the Company. Of the bonds and securities of other Companies, it was stated that 1381 shares of the Bell Electric Illuminating Company, with a face value of $129,500, had only a book value of $2. The actual properties of the Company were shown to be worth $2,741,243, allowing 25 per cent. reduction for depreciation. These were the figures handed to the Commissioners for the purpose of getting a reduction in the Company's taxes. Mr. Hughes asked if any of the patent rights obtained from the Westinghouse Company in 1889 had expired, and Mr. Whitely said he believed some of them had; but he added that they had rights in some Tesla patents. Mr. Hughes asked what franchises were covered by the $1,500,000 entry in the Company's report to the Tax Commissioners; and the witness said the United Electric Light and Power Company had a special franchise from the Board of Alderman to lay wires in the streets, notwithstanding that it used the ducts of the Consolidated Telegraph and Electrical Subway Company and paid rent for them. This rather surprised Mr. Hughes; and he asked to see a copy of the franchise. It was produced, and it proved to be an ordinance passed in 1881, vetoed by the Mayor, and eventually passed by the Alderman over his veto.

A portion of the work of the Committee consisted in an investigation of the affairs of the Brooklyn Companies. It was found that while the total par value of the stock and bonds of the seven Companies amalgamated to form the Brooklyn Union Gas Company amounted to $13,870,000, there was issued in acquiring the properties of these Companies $29,500,000 in stock and bonds. Since its organization ten years ago, the Brooklyn Union Company has not only paid 5 per cent interest on $14,500,000 of bonds thus issued, and 10 per cent. annual dividends on $15,000,000 of stock, but also $668,000 out of the earnings for securities of other Companies. Bonds amounting to $500,000, not issued at the time of the union, were used in the purchase of additional gas properties. It was admitted that the difference between the par value of the securities of the constituent Companies and the Union's own issue of securities ($15,630,000), an amount greater than the capital stock was represented by "goodwill;" and it was maintained that it was quite proper to capitalize the new Company on this basis, in consideration of the franchise and experience of the Companies composing it, even though the par value of these Companies' securities previous to the amalgamation had been only $13,870,000. The seven Companies acquired to form the Brooklyn Union Company, with their capital stock, were the Brooklyn, incorporated in 1848, $2,000,000; the Williamsburg, 1850, $1,000,000; the Citizens', 1891, $1,750,000; the People's, 1864, $1,000,000; the Nassau, 1867, $1,250,000; the Metropolitan, 1871, $870,000; and the Fulton Municipal, 1879, $2,100,000—making a total capital stock of $9,970,000. The outstanding bonds of the seven Companies at the time of their purchase amounted to $3,900,000; making the total of securities $13,870,000. These Companies were bought according to special agreements made between the men who organized the Brooklyn Union and the various other interests represented. The payments were made on the basis of 50 per cent. cash and the remainder in securities of the new Company.

These particulars were elicited from the two witnesses for the Union Company—General James Jourdan, the President, and Mr. Arthur F. Staniford, the Assistant-Treasurer, and, in addition, some interesting information was obtained. To the valuation of the properties of the constituent Companies there was added at the time of their purchase about $4,000,000 to the street main account and some $3,000,000 as the value of "the right to be a gas corporation," apart from the other increases for "goodwill." Mr. Hughes evinced much interest in the valuation of "the right to be a gas corporation" at $3,000,000; suggesting that several years before the State franchise tax law had been passed, the Brooklyn Union had already evolved the principle of valuing its corporate existence. As already stated, in the ten years the concern has been doing business, the Company, besides paying interest on their bonds and 10 per cent. dividends on their stock, have bought out of the earnings and a reserved bond issue of $500,000 the Flatbush Gas Company for $372,771, the Richmond Hill Company for $26,758, the Equity Company for $568,065, the Jamaica Company for $145,000, and the Woodhaven Company for $40,000—a total of $1,168,000. Debenture bonds for $3,000,000 have also been issued; but their proceeds were used for other purposes.

The statistical and technical portion of the inquiry was brought to a close by an inspection by the Committee of the Astoria works of the Consolidated Gas Company, a description of which has been given in the "JOURNAL," and of the waterside station of the New York Edison Company. All that remains to be done is to hear what are called the "political witnesses," and summarize the evidence in a report to the Legislature.

The Committee's Recommendations.

Since the foregoing was in type, we have received a copy of the "New York Herald" containing the Committee's recommendations, as follows:—

1.—That the price of gas sold in the boroughs of Manhattan and Brooklyn and in that part of the borough of the Bronx west of the Bronx River should be fixed at a maximum of 75 c. per 1000 cubic feet.

2.—That the pressure of gas in any of the street-mains should not be permitted to exceed 2½ inches or be less than 1 inch.

3.—That the standard of purity and of illuminating power of gas be fixed.

4.—That a proper system of inspection be provided to secure the enforcement of the law with reference to pressure, purity, illuminating power, and accurate measurement of the gas delivered.

5.—That the price of electric current for heat, light, and power purposes in the boroughs of Manhattan and Brooklyn and in that part of the borough of the Bronx west of the Bronx River, should be fixed at a maximum of 10 c. per kilowatt-hour of current actually consumed, and that provision shall be made for inspection to secure accurate metering.

6.—That the price of the lamps for street lighting for the city of New York should be fixed at $100 per lamp per year for single arc lamps of 2000-candle power, consuming 450 watts at the arc, and that the price of twin arc lamps, consuming 250 watts each at the arc, should be fixed at $65 each per year.

7.—That the city of New York be given authority to utilize water power, now owned or hereafter acquired by it, for the purpose of generating electric current for the use of the Municipality, provided that no additional water shall be used for said purposes than would otherwise be required by the city.

A Bill has been prepared by the Committee to carry their recommendations into effect. The following are its chief features: Appointment by the Governor of a Commission of Gas and Electricity, to consist of three members, to serve six years, at $6000 a year, and expenses payable by the State. No person is to be eligible as a Commissioner who has any connection with a lighting company. The principal office of the Commission to be in Albany, with branches in New York City and Buffalo. The Commission are to have general supervision of gas and electrical corporations, and to have power to fix the standard of gas, and regulate the pressure at which it shall be delivered; also to have control of the inspection of gas and electrical meters. No lighting corporation are to do business in the State, or any municipal plant to be put up, without a certificate of authority from the Commission. No corporation are to issue stock or bonds without approval. There is to be no consolidation of lighting corporations, and no holding company is to be formed without the consent of the Commission. Complaints against lighting companies, made either by municipalities or individuals, are to be heard and investigated by the Commission. In deciding complaints, the Commission may fix a maximum price for gas or electricity for three years at not more than the limit fixed by law, and may order improvements in the methods of manufacture or supply. Corporations may appeal from decisions of the Commission on complaints to the Appellate Division of the Supreme Court for the Third Department, which may modify the decisions. Any corporation, agent, or person charging more than the Commission's rate is to be guilty of a misdemeanour and shall be debarred from collecting the charge. In case of disobedience to the orders of the Commission, application is to be made to a special term of the Supreme Court, which shall enforce the order. An appropriation of $60,000 is made for the expenses of the Commission.

There is much interest in the portion of the Bill relating to municipal lighting plants, which sets forth as follows: "No municipality shall build, maintain, and operate for other than municipal purposes any works or systems for the manufacture and supplying of gas and electricity for lighting purposes without a certificate of authority granted by the Commission upon satisfactory evidence that the municipality are not at the time adequately supplied with gas and electricity, or that the existing supply thereof is impure and not of the required standard, or that provisions have been made as provided by law for the acquisition of existing works or systems."

It appears that there are to be separate Bills fixing the maximum price of gas and electricity in New York City; but no Bill is being drawn by the majority to empower the city to use its surplus water for producing electricity, as recommended in the report.

Public Lighting of Newmarket.—The Newmarket Urban District Council have agreed to the recommendation of their Committee that the tender of the Gas Company for the public lighting should be accepted for five years, instead of three years as previously. The price per year for this period is £928 5s., or a reduction of £50 per annum compared with the present payment. The Electricity Company tendered for a portion of the lighting; and bearing in mind the contests that have taken place over the public lighting contract in past years, it is significant that on the present occasion there was practically no comment on the offers. Clearly the Gas Company, under the able generalship of Mr. J. H. Troughton, have, by means of up-to-date incandescent lighting, driven electricity out of the field.

BURTON-UPON-TRENT GAS AND ELECTRICITY WORKS.

The Past Year's Operations.

At the Monthly Meeting of the Burton-upon-Trent Town Council last Wednesday, the annual reports on the gas and electricity undertakings were presented by Alderman Lowe, who, referring to the sound position of the gas-works, said he thought they should send their congratulations for the success attained to Mr. F. L. Ramsden, the Engineer and Manager, who they were sorry was unable to be present.

In the course of this statement, Alderman Lowe said that, looking carefully through the accounts for the year for the gas-works, the Committee felt that, though the substantial profit made last year had not been quite equalled, yet the result was one on which they could congratulate themselves, for after contributing £5000 in aid of the rates, and providing considerable sums for depreciation, there was still a small balance left to go to the reserve fund. Now this result had been achieved in spite of the fact that they had to report, for the first time for many years, that their sales were down as compared with the previous twelve months. The Committee very much regretted this falling off. They had given the matter careful consideration, and found it was due almost entirely to the depression in trade from which the town had for some time been suffering. The slot meters and small consumers had actually burnt more gas than hitherto; but the falling-off was principally from the large firms of the town, owing, as he had already stated, to trade depression. He trusted, however, that, as things began to improve once more in the country, they, too, in Burton might find their star again in the ascendant. Then another factor which had had some influence on the amount of gas sold had been the incandescent mantle. This they did not discourage, because they knew that anything which improved the gas-light for general use would in the long run contribute to the success of the undertaking. Now, in face of all this, he thought the result of last year was very satisfactory; and their one regret was that Mr. Ramsden was not present to hear the congratulations which, he was sure, every member of the Council would wish to give him. The heavy fall in the price obtained for both coke and tar during the past year swallowed up more than the amount saved by the low price paid for coal. With regard to a comparison that had been made between Burton and Sheffield in the matter of the price of gas, he pointed out that Burton was not so favourably situated for the disposal of residuals as Sheffield, which had a large manufacturing area, and where there was a great demand for the bye-products, while Sheffield, too, was in the midst of a gas-coal country. The Committee had continued their efforts to reduce the leakage. The sum of nearly £2000 had been spent; but they had had a corresponding drop to under 10 per cent. loss during the year. Considering it was only a few years since the loss was over 13 per cent., it would be seen that they were making substantial progress; and though the remedy was worse than the disease from the cost point of view, yet the time would come when he trusted the works would reap the advantage of their steady efforts. Though the demand for slot meters had continued during the past year (337 having been fixed), the time was approaching when this class of consumer must be fully supplied. At present, they had 4623 prepayment meters in use, which, together with over 4963 ordinary consumers, showed that unless the town extended the demand could not go on much further. While the total capital outlay on the works, &c., was £210,000, the outstanding debt only amounted to £68,000. This, he thought, was a very sound financial position to be in; and he hoped that in the future the position would be even stronger than to-day, through their loans running out.

Referring to the electricity undertaking, Alderman Lowe said that the accounts were hardly so satisfactory as last year, as they had only a surplus of £357, as against nearly £1200. This decrease arose from a variety of causes, all more or less of a temporary nature. Though the revenue had increased by £830, yet the expenditure had gone up about twice this amount. There were several factors which had had an influence in bringing about this result. In the first place, the number of units sold for lighting did not increase in the proportion that they should have expected, considering that they had an additional 3368 8-candle lamps connected, or equal to a 14 per cent. increase. This they must attribute to trade again. In the second place, the Council would remember that they re-arranged their scale of charges last autumn; and consequently the consumers had had the benefit of five quarters' rebate on the maximum demand in one year. Whether they were wise or not in this, he would not say; but, at any rate, the consumers had had the advantage, which made a difference to the surplus of about £400. This would not occur again another year. Then they had also had an exceptionally heavy bill for repairs.

After a short discussion, the Committee's minutes were adopted.

The receipts from the sale of gas for the twelve months ending March 31 amounted to £42,194, as compared with £44,120 in the previous year; from street lighting, to £4770, against £4704; meter and stove rents, to £1241, against £1223; coke, tar, lime, and carbon, £8410, against £10,406; and ammoniacal liquor, £4061, against £3985. Other items, and stock in hand, brought the total receipts up to £61,605, as compared with £65,334 in 1903-4. On the other side of the account, coal cost £18,048, against £20,564; carbonizing wages and unloading, £5075, against £5339; purification £960, against £1128; maintenance and general repairs of works, £3663, against £3658; renewal and repair of retorts, £1591, against £1240; repairs to mains and services, £1986, against £1938; rents, rates, taxes, and insurance, £3696, against £3462; street lighting, £1464, against £1452; and interest on, and repayment of, loans and stock, £9559, against £9769. Out of the profits, £5000 has been contributed in relief of the rates, as previously, and £4300 has been placed to the deterioration fund extinguishing the capital outlay on prepayment meters, fittings, and stoves; while all expenditure during the year on prepayment meters and fittings has been charged to revenue.

PRICE OF GAS AT ROCHDALE.

In accordance with notice, Mr. Sharp moved the following resolution at the last meeting of the Rochdale Town Council: "That, having regard to the fact that the gas profits for the financial year ending March 31, 1905, amount to over £19,000, it be an instruction to the Gas Committee to take into consideration at an early date the question of substantially reducing the price now charged for the supply of gas." In doing so, he gave the Council some examples of the unfairness of the present system of relieving the rates at the expense of the gas consumers. One mill, he said, which was lighted mainly by electricity, paid about £36 for gas and derived financial benefit from the gas profits to the extent of £134; while another mill using gas paid for it £396, and only benefited to the extent of £69. In Rochdale, the present price was 2s. 10d. per 1000 cubic feet, or 2s. 8d., calculating the 2d. per 1000 feet discount. In Blackpool, Ashton, and Stalybridge, the charge was 2s. 4d.; St. Helens, Leeds, Oldham, and Burnley, 2s. 3d.; Halifax and Salford, 2s. 0½d.; Bury, 1s. 10d.; Widnes, 1s. 3d.; and Heywood, 2s. 1od.

After the resolution had been seconded, a motion "that the Council proceed to the other business of the day" was carried by the requisite two-thirds majority; and the matter therefore fell through. Earlier during the same meeting, however, it had been announced that the Gas Committee were considering the question of a reduction, and that when next the Council assembled a new scale of charges would no doubt be submitted.

STOCKTON CORPORATION GAS SUPPLY.

The Past Year's Working.

The Manager of the Stockton Corporation Gas-Works (Mr. W. Ford) has lately presented his report on the working in the year ended the 31st of March last. The total quantity of gas made was 365,489,000 cubic feet, of which 353,435,100 cubic feet were sold, and 3,575,800 cubic feet used on the works; leaving 8,478,100 cubic feet unaccounted for. There was a decrease of 17,400,000 cubic feet, or 4·54 per cent., in the gas made compared with the previous year, and a leakage of 2·32 per cent., compared with 2·82 per cent., on the total make. Mr. Ford explains that the decrease in the make may be accounted for by the slackness of business and the mildness of the past winter, the increasing use of incandescent burners, and the loss of some large works as customers. But, he says, it must be remembered, in taking these into account, that there was an increased make of 12 million cubic feet in the previous year; so that some of the loss in the past year may be expected to be recovered in the near future, with reduced price, increasing prosperity, and the recommendation of the Stores Committee to deal more liberally with the slot-meter consumers will, in his opinion, lead to increased consumption—this department being fully employed, with bright prospects in the immediate future. The number of ordinary meters fixed during the financial year was 878, and of slots 815, or a total of 1693. The meters brought to stock were 820, and 684 were reissued as exchanges. There were 369 cookers fixed, 380 were brought to stock, and 106 in exchange. The grillers fixed were 203. The coke-discharging machinery for the retort-house is all but finished. By the resolution of the Stores Committee above referred to, consumers of gas on the penny-in the-slot system are allowed the use of a gas cooking-stove and also one bracket, fixed at a distance not exceeding 20 feet from the meter, free of cost.

RIPON CORPORATION GAS SUPPLY.

The Past Year's Working.

The Gas Engineer and Manager of the Ripon Corporation (Mr. W. T. Lancaster) has presented to the Gas Committee his report for the year ending the 31st of March. It opens with the satisfactory statement that the unaccounted-for gas was only 2·91 per cent. of the total quantity sent out; whereas for the preceding year it was 4·96 per cent., and 14·72 per cent. for 1902-3. He submitted a series of six-monthly statements of the gas made, sent out, and unaccounted-for since his appointment in March, 1902; and they show progressive improvement. The quantity of gas made last year was 35,701,500 cubic feet, against 36,419,300 cubic feet for the year 1903-4; while the quantity sent out was 35,706,554 cubic feet, compared with 36,440,806 cubic feet. Mr. Lancaster says this was doubtless due to the general reduction in the leakage. The quantity of coal carbonized was 3357 tons 14 cwt., yielding an average of 10,632 cubic feet of gas per ton, compared with 3448 tons 6 cwt. in the year 1903-4, with an average make of 10,561 cubic feet per ton. Having given details in regard to the residual products, Mr. Lancaster says the total wages for the year came to £1357, of which £1293 was paid out of revenue and £65 out of capital. In the previous year, the total was £1664, of which £1405 was paid out of revenue and £258 out of capital; showing a decrease of £112 on revenue and £193 on capital account. The carbonizing costs per 1000 cubic feet of gas made were 2·26d., against 2·39d. in 1903-4; and the cost of gas into the holder (exclusive of the value of residuals and materials) was 5·49d. per 1000 cubic feet, against 6·83d. before. As the whole of the work was done by hand, without the aid of stoking machinery, conveyors, &c., Mr. Lancaster thinks the results obtained will compare favourably with works of similar size. The number of public lamps is 316, of which 279 are incandescent, 30 flat-flame, and 7 private; and he suggests that during the current year the whole of the city should be lighted on the incandescent system. The number of mantles used was 12·3 per burner, against 11·91 before; the increase being due to heavy gales. The number of slot meters in use was 655, compared with 607; and of ordinary meters, 1038, against 1035. Mr. Lancaster

concludes by pointing out to the Committee that they commenced the year with a balance of £104 16s. 11d. on capital account; and that during the year everything was paid for out of revenue. On March 31, 1904, the balance owing to the bank was £3948; at the corresponding date this year it was £3703—a reduction of £245, after paying, as stated, all capital charges out of revenue (with the exception of the £104 16s. 11d.), meeting interest and sinking fund charges, and lighting the streets free. He hopes this year to show further improvements. We are pleased to learn that, in recognition of the results he has achieved, Mr. Lancaster has been granted an increase of £30 per annum in his salary.

WALKER AND WALLSEND GAS COMPANY.

The Proposed Increase of Capital.

An Extraordinary Meeting of the Walker and Wallsend Union Gas Company was held last Friday, to deal with the proposed raising of new capital. Colonel Crawford, who presided, said he was glad to report that the Company's Act of this session had practically passed, having been confirmed by both Houses. It now only awaited the Royal Assent to become law. The Directors, with the object of concentrating the works on the new site at Willington Quay as speedily as possible, had entered into negotiations for the purchase of the land. The capital expenditure already incurred for general extensions to meet the rapidly increasing demand for gas, and to be incurred in the laying down of works on the new site, necessitated the creation and issue of further stock and loans, for which the sanction of the proprietors was required. The recommendations which the Directors submitted were, first, to rescind that part of the resolution of the proprietors of Dec. 4, 1903, creating £12,000 of new preference stock, and to adopt another resolution with provisions to consolidate the issues of preference stock under the present Act and any subsequent Act relating to the Company. Unless this was done by resolution of the proprietors at the time of creating new preference stock, there would be the danger of having separate and distinctive preference stocks with each subsequent Act. Therefore, it was proposed to rescind the resolution already passed, and to substitute another resolution providing that the issue rank *pari passu* with any other preference stock having the same designation and dividend, which might at any time hereafter be created and issued under the 1903 Act, or any subsequent Act. Secondly, it was recommended to sanction the creation and issue of £20,000 of new 5 per cent. ordinary stock; and, thirdly, to allow the Directors to borrow on mortgage in accordance with the terms of their Act. These resolutions would empower the Directors to raise from time to time a total, inclusive of premiums, of something over £50,000. The resolutions were subsequently carried.

A gas exhibition extending over four days has been held at Brixham. Cookery lectures and demonstrations were given by Mrs E. K. Deane; and on the opening day Mr. W. A. Schultz, F.C.A., gave an address on the advantages of gas as a means of cooking. Speeches were also made by representatives of the Richmond Gas Stove and Meter Company and Messrs. Willey and Co.

WHICH IS PREFERABLE—GAS OR ELECTRICITY?

This was the subject of a debate at a recent meeting of the Hackney Debating Society, on which occasion Mr. F. H. Parsons was in the chair. An opportunity for opening the debate having presented itself, Mr. F. W. Goodenough, the Chief Inspector of the Gaslight and Coke Company, accepted it; the result being a very interesting discussion, though there was hardly sufficient opposition to give the challenger good scope for reply.

Mr. Goodenough, in the course of his opening, referred to the welcome that electricity first received in the days of the old flat-flame burner. The Welsbach mantle, however, had brought about quite a revolution in the use of gas as an illuminant; and public opinion had also been altered somewhat with regard to the use of electricity for lighting purposes by the quarterly bill. It had been found, too, that electric light was a somewhat fickle friend, and had a habit of going out when it was most wanted. He understood that failure in the electrical supply was not an unfamiliar occurrence—even in Hackney. Then, in Battersea, some shop-keepers, who had relied on electricity, had, on a recent Saturday evening, at the busiest time, to be content with candles stuck in bottles. On the same occasion, the theatres had to be emptied. Altogether, there was plenty of evidence to show that electricity was not so reliable as gas for lighting purposes. A curious point was that electrical engineers professed to be almost in ignorance of any other class of burner for gas than the old flat-flame burner; and they continued to compare it with the electric glow lamp. It was true the British public had been somewhat slow in adopting the incandescent gas system. But in Continental towns, as he (Mr. Goodenough) had found by personal investigation, the incandescent burner was in almost universal use. In Belgium, Germany, and Austria, two years ago, he found the incandescent had entirely displaced the flat-flame burner; and he could not find one of the latter in Brussels, Berlin, or Vienna, and very few in Paris. Regarding public lighting on the Continent, Berlin was the best lighted city in the world; and it was worth while noting that, with two exceptions, all the thoroughfares there were illuminated with incandescent gas-burners, many of them supplied with gas at high pressure. In regard to cost, incandescent gas lighting was, light for light, a far cheaper illuminant than electricity, whether used in glow lamps, Nernst lamps, or arc lamps. The relative costs for a light of 1000-candle power for 1500 hours in the year, including all expenses of mantle or lamp renewals, were shown to be (taking electricity at 4d. per unit):—

Incandescent gas-burners	£20
Incandescent burners at increased gas pressure	13
Electric glow lamps	105
Electric Nernst lamps	45
Electric arc lamps (open)	23
Electric arc lamps (enclosed)	35

It was of importance to consider in a subject of this kind the practical opinion of those who had used both systems. It was a somewhat startling fact that, within the last two years, his Company had taken the electric light out of 1240 premises and re-instated gas. The parties concerned had been anxious to pay even a considerable sum of money

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 425.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 13	10½	Alliance & Dublin 10 p.c.	21—22	..	4 15 5
160,000	10	,,	7½	Do. 7 p.c.	14—15	..	5 0 0
200,000	5	May 12	6½	Bombay, Ltd.	6¾—7*	..	4 12 10
140,000	5	,,	6½	Do. New, £4 paid	5—5⅛*	+¼	4 14 6
50,000	10	Mch. 15	14	Bourne-	29½—30½	..	4 11 10
251,810	10	,,	7	mouth Gas	16½—17½	..	4 0 0
53,200	10	,,	6	and Water	15⅛—16½	..	3 12 9
380,000	Stk.	Feb. 24	12	Brentford Consolidated	247 252	..	4 15 3
300,000	,,	,,	9	Do. New	18,—190	..	4 14 9
50,000	,,	,,	5	Do. 5 p.c. Pref.	127—132	..	3 15 9
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb.	105—108	..	3 14 1
220,000	Stk.	Mch. 15	11	Brighton & Hove Orig.	223—228	..	4 16 6
246,320	,,	,,	8	Do. A. Ord. Stk.	165—170	..	4 14 2
460,000	20	Mch. 30	10	British	40—41	−½	4 17 7
100,000	Stk.	Feb. 24	6	Bromley, Ord. 5 p.c.	118—123	..	4 17 7
165,700	,,	,,	4½	Do. do. 3½ p.c.	90—94	..	4 15 9
500,000	10	May 12	7	Buenos Ayres (New) Ltd.	12—12⅝*	..	5 12 0
250,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
150,000	20	Mch. 15	8½	Cagliari, Ltd.	25—27	..	6 2 3
100,000	10	Sept. 29	10	Cape Town & Dis., Ltd.	17½—18	..	5 11 1
100,000	10	Apl. 28	4½	Do. 4½ p.c Pref.	9½—10	..	4 10 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54*	..	5 11 1
50,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	100—102	..	4 8 3
1,400,000	Stk.	Feb. 24	5⅛	Commercial 4 p.c Stk.	112—115	−2	4 10 5
560,000	,,	,,	5	Do. 3½ p.c. do.	109—112	−2	4 9 3
450,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	86—88	..	3 8 2
800,000	Stk.	,,	6½	Continental Union, Ltd.	110—113	..	5 15 1
200,000	,,	,,	7	Do. 7 p c Pref.	140—145	..	4 16 7
424,070	Stk.	Feb. 18	5½	Derby Con. Stk.	121—125	..	—
55,000	,,	Jan. 3	4	Do. Deb. Stk.	108—110	..	3 12 9
486,090	10	Jan. 27	11	European, Ltd.	22—23	..	4 15 8
354,060	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
15,243,200	Stk.	Feb. 10	4⅛	Gas- 4 p.c. Ord.	95½—99½	+1	4 8 5
2,600,000	,,	,,	3½	light 3½ p.c. max.	92—94	..	3 14 6
3,709,735	,,	,,	4	and 4 p.c. Con. Pref.	109—112	..	3 11 5
4,193 975	,,	Dec. 15	3	Coke 3 p.c. Con. Deb.	90—92	..	3 5 3
258,740	Stk.	Mch. 15	5	Hastings & St. L. 3½ p.c.	100—103	..	4 17 1
70,000	10	Apl. 28	11	Hongkong & China, Ltd.	16½—17½	+½	6 5 8
3,800,000	Stk.	May 12	10	Imperial Continental	213—216*	−1	4 12 7
473,600	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 5
175,242	Stk.	Mch. 15	6	Lea Bridge Ord. 5 p.c.	120—125	..	4 16 0
561,000	Stk.	Feb. 24	10	Liverpool United A	221—223	..	4 9 8
718,100	,,	,,	7	Do. do. B	164—166	..	4 4 4
306,083	Stk.	Dec. 30	4	L'rpool Unit'd Deb. Stk.	111—113	..	3 10 10
75,000	5	Dec. 15	5	Malta & Medn., Ltd.	4¼—4⅜	+⅛	5 5 3
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	101—103	..	4 17 1
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	101—103	..	4 17 1
541,920	20	Nov. 11	3½	Monte Video, Ltd.	11⅜—12½	..	5 12 0
1,565,892	Stk.	Feb. 24	4½	Newc'tle & G'tesh'd Con.	110—111	−½	4 3 0
406,625	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	92—93	..	3 15 3
15,000	10	Feb. 24	10	North Middlesex 10 p.c.	19—20	..	5 0 0
52,940	1)	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	May 12	8	Oriental, Ltd.	145—148*	+½	5 8 1
600,000	5	Mch. 30	7	Ottoman, Ltd.	6—6½	..	5 12 0
235,005	Stk.	—	6½	Plym'th & St'house 5 p.c.	—	..	—
398,490	5	Apl. 28	6	Primitiva Ord.	5⅜—6¼	..	4 16 0
796,980	5	Jan. 27	5	Do. 5 p.c. Pref.	5⅜—5⅝	..	4 13 0
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
851,070	10	Apl. 28	7	River Plate Ord.	11⅜—12¼	−¼	5 14 3
300,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
250,000	10	Apl. 13	7	San Paulo, Ltd.	12⅛—13	..	5 7 8
70,000	50	Jan. 3	5	Do. 5 p.c. Deb.	52—54	..	4 12 7
135,000	Stk.	Mar. 15	10	Sheffield A	234—236	..	4 4 9
209,984	,,	,,	10	Do. B	234—236	..	4 4 9
523,498	,,	,,	10	Do. C	233—235	..	4 5 1
123,998	Stk.	Mch. 30	5	Shrewsbury Ord. 5 p.c.	107—110	..	4 10 11
70,000	10	,,	11	South African	16—17	..	6 9 5
6,250,000	Stk.	Feb. 10	5⅓	South Met., 4 p.c. Ord.	127—129	..	4 5 3
1,832,700	,,	Jan. 13	3	Do. 3 p.c. Deb.	89—91	..	3 5 11
575,000	Stk.	Feb. 24	5⅓	S'th Suburb'n Ord. 5 p.c.	120—123	..	4 9 5
60,000	,,	,,	5	Do. 5 p.c. Pref.	122—.27	..	3 18 9
112,533	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	130—135	..	3 14 1
502,310	Stk.	May 12	5	Southampton Ord.	105—108*	+½	4 12 7
87,950	,,	—	4	Do. 4 p.c. Deb.	—	..	—
120,000	Stk.	Feb. 24	6¾	Tottenham A 5 p.c.	125—128	..	4 17 8
338,120	,,	,,	4¾	and B 3½ p.c.	98—101	..	4 14 1
125,000	,,	Dec. 15	4	Edmonton 4 p.c. Deb.	107—110	..	3 12 9
182,380	10	,,	8	Tuscan, Ltd.	9⅜—10½	..	7 16 1
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
30,000	Stk.	Feb. 24	7⅜	Wands- A 5 p.c.	163—168	..	4 12 3
255,636	,,	,,	6¾	worth B 3½ p.c.	135—140	..	4 9 3
60,000	,,	,,	5⅛	and C 3½ p.c.	113—115	+2	4 14 4
57,564	,,	Dec. 30	3	Putney 3 p.c. Deb. Stk.	82—87	..	3 9 0
745,872	,,	Mch. 15	5	West Ham 5 p.c. Ord.	102—104	..	4 16 2
185,000	,,	,,	5	Do. 5 p.c. Pref.	123—126	..	3 19 4
193,300	,,	Dec. 30	4	Do. 4 p.c. Deb. Stk.	105—110	..	3 12 9

Prices marked * are Ex div.

to have this done. In the autumn of 1903 he had an interview with the Engineer of the London, Brighton, and South Coast Railway, with regard to the lighting of Victoria Station. The Company were then generating their own electricity for lighting the station; but they decided to go back to gas after considering figures which he (Mr. Goodenough) submitted. In September, 1904, he wrote to the Engineer of the Company, and asked him how his (the writer's) figures were "coming out." The reply was to the effect that they had saved over £550 in the half year; and it was added that the station was more efficiently lighted. However, if a person was really bent on having electric light, the best thing for him to do was to use a gas-engine and dynamo, and make it for himself. The London County Council used gas-engines for the purpose; they were also employed at the Agricultural Hall. This was found to be an economical means of obtaining the necessary power, and the electric light could be made at a much cheaper rate than it could be bought at. Generally speaking, lighting by gas could be carried out at half the cost of lighting by electricity, with a very much better light.

The CHAIRMAN, having referred to the facts and figures that had been brought to the notice of the members, said it would be interesting to know why an invitation, equally emphatic to that which had brought two representatives of a great Gas Company [with Mr. Goodenough was Mr. Hood, the Chief Inspector for the Hackney and East London Division] to the meeting, had not been accepted by those who had to do with the electric lighting undertaking in the Borough of Hackney. As honorary organizer of debates for the Society, he invited Mr. Robinson, the Borough Electrical Engineer, to be present; and he also wrote to two or three members of the Electric Lighting Committee, urging them to be there during the debate. The only conclusion that could be arrived at was that they were somewhat afraid of the arguments that might be raised. He had had an opportunity of going into the work done in connection with the electric lighting undertaking by the Borough Council of Hackney; and it appeared that during the past six years they had succeeded in securing something like 958 users.

Among those taking part in the debate were Mr. TATE, Mr. COHEN, and Mr. DAY. Mr. Tate submitted that the use of gas was much cheaper and better than electric light. Mr. Cohen stated that, at his place of business, they used electricity for power purposes; and, in this way, found it very efficient. They had at work a small 3-horse power motor. He thought that the usefulness of electric motors was far in advance of gas-engines. The electric motor took up very little room; and, by the use of one in the business with which he was associated, they estimated that they had saved in the last quarter. Mr. Day, who is a photographer, said he was one of the first to have his place of business supplied with electricity. After a time he began to think it was becoming a bit dear; and in the end he tried gas again in certain parts of his establishment, with the result that, in a quarter corresponding with a similar period last year, he found a difference of 18s. in favour of gas. In addition, a better light was secured.

Mr. GOODENOUGH, answering a question as to the comparative charges for gas on the north and south side of the Thames, said there were several reasons for this. The Gaslight and Coke Company were the pioneers in the matter of lighting. They had had to bear enormous initial expenses. After proceeding for some years, the Company had to root up certain works in London. One was on the site of the present De Keyser's Hotel. That was the old Blackfriars works. His own uncle was Engineer at those works for some years. Enormous works at Beckton followed as a result of these changes. The Company were therefore loaded with capital expenditure in one way and another—one of the causes being the fact of having to remove their works. One other reason was that on the north side of the Thames the Company had most expensive paving to deal with. In effecting alterations or repairs, the workmen more generally than not had to deal with asphalte, tar, or wood paving. This, compared with the macadamized roads that had to be dealt with on the south side of the Thames, made a considerable difference. Another point he would submit was the difference in the local rates.

Very cordial thanks were tendered to Mr. Goodenough at the close of his reply.

SUBWAYS FOR GAS AND WATER PIPES.

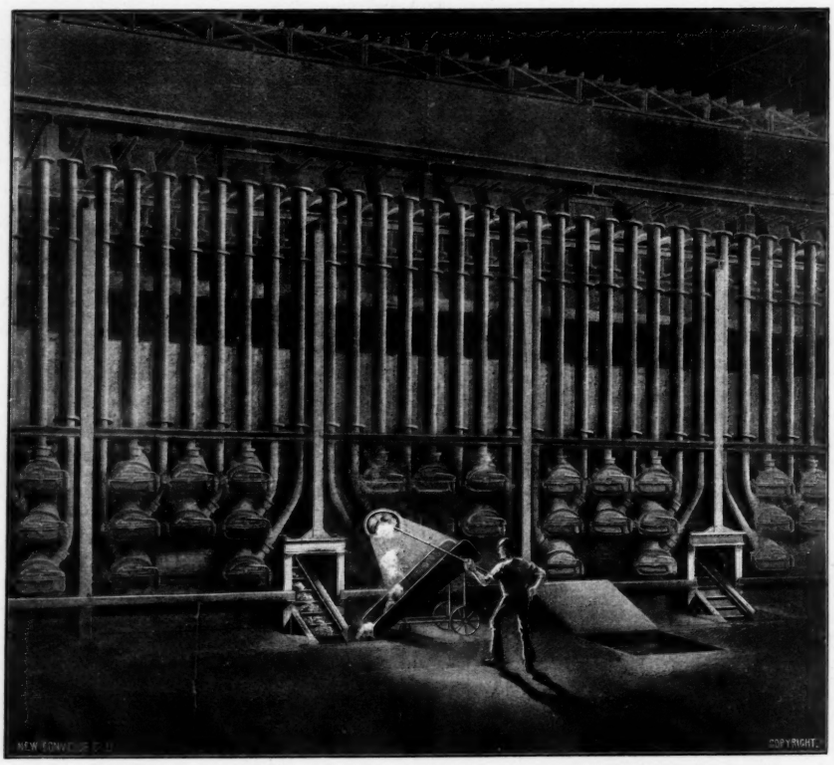
In the report of the Engineer to the Corporation of London from which we extracted the particulars in regard to the public lighting that appeared last week, he gives an account of the subways, and shows the extent to which they are used for gas, water, and other pipes. It appears that there existed at the end of last year 2707 lineal yards (about 1⅝ miles) of subways under the control of the Corporation, and 1 mile 661 yards not in their charge. The lengths of gas, water, and hydraulic mains, telegraph, telephone, and pneumatic tubes, and electric lighting conduits laid in the subways of the Corporation amounted to 13 miles 790 yards; being an increase of 1136 yards during the year. The City subways are occupied as follows:—

	Miles.	Yards.
Gas-mains	2	693
Water-mains	1	1638
City of London Electric Light Company	1	1481
Charing Cross ,, ,, ,,	1	1624
London Hydraulic Power Company		1656
Pneumatic tubes (G.P.O.)	1	1353
Telegraphs and telephones (G.P.O.)	2	1142

The usefulness of the subways is evidenced by the fact that, in the streets in which they have been constructed, no openings have been made for access to pipes, &c. (excepting those for taking pipes into the subways), since they were completed. Access, under proper supervision, is given to the officers and workmen of the various companies; and during last year 4839 workmen and others were admitted.

No Drawing Stage.

Perfect Regeneration.



Producer Fed with Hot Coke.

PATENT "DWARF" INCLINED RETORT-BENCH.

NEW CONVEYOR CO., LTD., SMETHWICK.

SERIOUS GAS EXPLOSIONS IN PARIS.

A remarkable series of gas explosions happened shortly after midday last Thursday on the Boulevard de Sébastopol, Paris. The portion of the boulevard which suffered most was that lying between the Rue Réaumur and the Rue Sainte-Appolline; and the accident resulted in injury to about forty people, though happily it was not serious, except in a few cases. Being the luncheon hour, there were fewer people on the boulevards than during the rest of the day, or the consequences might have been disastrous. The first explosion occurred opposite No. 125; and the result was the upheaval of the pavement for a distance of about 10 yards. This was followed in succession by others not less violent, at intervals of a few seconds, the effect of which was to convert the footway, for a distance of rather more than 500 yards, into a series of trenches. Earth and stones were thrown into the air in all directions, shop-fronts were damaged, and the houses in the vicinity shaken from their foundations to the third and fourth storeys. The passers-by who were only slightly injured received attention on the spot, and were able to go to their homes; the others were conveyed to the hospitals. Firemen and some of the officials of the Gas Company were promptly in attendance, and the gas was cut off. The Commissioner of Police for the district (M. Duponnois) also came quickly upon the scene, and commenced an investigation into the circumstances. It brought out the following facts: There were two gas-mains—one a 28-inch and the other a 6-inch—in the ground; the larger one being temporarily out of use pending the completion of the works connected with the Metropolitan Railway. This main, before being left, was, as it was believed, cleared of gas by the process usually employed by the Gas Company, and the two ends were plugged. The smaller pipe, lying parallel to the other, was in service for the supply of the houses on the boulevard. Between the two gas-pipes was the conduit containing the electric cables. Both the gas-pipes exploded; but which was the first to give way, it is impossible to say. An escape of gas certainly occurred—in the opinion of some, from the smaller pipe, while others considered that an explosive mixture remaining in the larger one had been fired. The question was how this had been done. One theory advanced was that the railway works had disturbed the electric conduits and caused a short-circuit, the resulting spark igniting the accumulated gas. On the other hand, it was stated that one of the men working in a trench near the larger main had been seen smoking a few minutes before the accident; and therefore it may be supposed that the lighted end of his cigar may have brought about the catastrophe. It is useless, however, to speculate upon the cause. The whole matter is being investigated by a Commission of experts, consisting of M. Manœuvrier, the distinguished electrical engineer, Dr. Bordas, one of the professors at the Collège de France, and Chief of the Laboratories at the Ministry of Finance, and M. Debrie, architect. Moreover, M. Rebeillard, the representative of the district on the Municipal Council, has intimated his intention of putting some questions to the Prefect of the Seine (M. de Selves), as to the responsibility for the accident, when the sittings of that body are resumed. So that something more will be heard about it. Whatever the conclusion arrived at, it is gratifying that there has been no loss of life.

METROPOLITAN WATER BOARD.

The first Meeting of the Board after the Easter recess was held on Friday—Sir R. M. Beachcroft in the chair.

The Works and Stores Committee reported that they had had brought to their notice a report by the Chemist of the Lea Conservancy Board on a sample of the effluent discharged into Cobbins Brook (and thence into the River Lea) from the Royal Gunpowder Factory at Waltham, about three miles above the intake of the eastern district at Ponder's End. The report stated that the sample was refuse from some chemical process, and that it was a corrosive and poisonous liquid, extremely objectionable in every respect for discharge into any watercourse. They understood that frequent complaints had been made to the War Office by the Lea Conservancy in respect of the serious pollution of the river from the factory. Having regard to the close proximity of the Board's intake, the matter was one of the greatest importance, and they had accordingly called the special attention of the Board's representatives upon the Conservancy to the matter. The Committee recommended that a communication should be addressed to the War Office, calling attention to the unsatisfactory nature of the effluent from the Royal Gunpowder Factory at Waltham Abbey, and asking that such steps might be taken as would remedy the pollution thus caused to the River Lea. This was agreed to.

The report of the Works and Stores Committee also dealt with the question of the improvement of mains for fire purposes. It stated that on March 31 the Committee reported that they had before them a request from the London County Council that some 1500 feet of 8-inch main should be laid at the expense of the Board for the purpose of improving the supply to the fire-hydrants in Norman Road, Greenwich. The Clerk of the Board had replied to that request, stating that they were desirous of taking all means in their power for providing an adequate supply of water for fire purposes, and pointing out that the only question outstanding between the Council and the Board was that of the principle as to whether the cost of improving the supply from mains for fire purposes should be borne by one or the other body. The Board were willing to carry out the works in question at the cost of the Council, on the understanding that the ultimate decision to be arrived at with regard to the allocation of cost was to apply to this particular case. The Council, in reply, expressed their regret that they could not see their way to agree to the proposal made by the Board. On the recommendation of the Committee, the Board agreed not to take any further

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19 ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. Telegraphic Address: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	TONBRIDGE	300,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	STRETFORD	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	OLDBURY	300,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	TODMORDEN	500,000
BIRKENHEAD	2,250,000	ST. CATHERINES (2nd Cont.)	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	YORK (Second Contract)	750,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	ROCHESTER (Second Contract)	500,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	NEWPORT (MON.)	250,000
HALIFAX	1,000,000	YORK	750,000	TOKIO, JAPAN	1,000,000
TORONTO	250,000	ROCHESTER	500,000	PERNAMBUCO (Brazil)	125,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	MALTON	150,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	DULUTH, MINN. (2nd Cont.)	300,000
MONTREAL	500,000	DULUTH, MINN.	300,000	BROCKVILLE (ONT.)	250,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	SMETHWICK	500,000
BELLEVILLE	250,000	LEICESTER	2,000,000	GRAVESEND	300,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	NEWPORT MON. (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	TORONTO (Third Contract)	750,000
		BURNLEY	1,500,000	TORONTO (Fourth Contract)	1,000,000
		KINGSTON-ON-THAMES	1,750,000	MONTREAL, ONT. (2nd Cont.)	1,800,000
		ACCRINGTON	500,000	HAMILTON, ONT.	400,000

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft

AND IN ADDITION, 7,900,000 CUBIC FEET DAILY; also Coal-Gas Plants at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

action at the moment; the Committee considering that any responsibility in the matter must now rest with the Council.

A statistical return of information relating to the supply for March last was presented. It showed that the total average daily supply amounted to 204,651,000 gallons. The number of houses supplied was 1,024,007, and the estimated population was 6,743,348. The mean supply per head per day was 30 33 gallons; the figure for the corresponding month of last year being 30·46 gallons. The quantity of water in store in impounding reservoirs at the end of March was 6438 million gallons.

NEW YORK WATER SUPPLY.

Proposed New Scheme.

A large scheme for supplying New York City and other cities of New York State with pure water has just been proposed by a Mr. Charles G. Armstrong. His plan is to tap the Great Upper Lakes with an aqueduct that would be built along the route of the old Erie Canal, the cost to be about $150,000,000, or £30,000,000. According to particulars in the "Engineer," it is proposed that the State should build the aqueduct, tapping 87,400 square miles of water in the Great Lakes. All cities and towns in central New York, as well as Troy, Albany, New York City, and its surrounding country, could be supplied from this main. The water would reach the city at a pressure of about 200 lbs. to the square inch; and it is part of the scheme that this power should be utilized to generate electricity and pump for a system of salt water fire and street-cleaning mains, &c. The following is an outline of Mr. Armstrong's report on the matter: Beginning at Lake Erie, a suitable intake would be constructed which would discharge the water into a cement aqueduct or aqueducts made of the best quality and by the newest methods; this aqueduct being wound with steel wire, which will make a pipe capable of sustaining any pressure. This aqueduct, it is suggested, should follow the right-of-way already owned by the State of New York (the Erie Canal) until the vicinity of Schenectady is reached, when it could run in a more or less straight line to the city. It could be built to sustain a pressure of some 500 lbs. to the inch, and be large enough to deliver 1000 million gallons of water every 24 hours. This amount, it is pointed out, is only 1-400th part of the water that flows over the Falls of Niagara, and would be too insignificant to make any perceptible change in these falls. The conduit would pass through or near most of the large cities of the State. Lake Erie is 580 feet above the sea level, and a very large percentage of water would be delivered in New York at a point 112 feet above. This would permit of the entire city being supplied without pumping. In case an uneven or hilly route should be selected instead of along the Erie Canal, the above head of 580 feet could, Mr. Armstrong thinks, be readily increased to 1000 or 2000 feet by means of pumping plant at Niagara Falls, which, being State property, could be operated with practically no expense.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Dumfries Town Council at the end of last week had before them a recommendation by the Gas Committee that benzol be employed to enrich the gas, and that authority be given them to purchase a carburettor, at a cost of about £350. Mr. Currie explained that the object of using benzol was to enable them to employ a cheaper coal, and to still produce as good gas, if not better. They would be able, in the summer, to make an 18-candle gas; and the benzol would bring it up to 22 candles. After some discussion, the recommendations of the Committee were agreed to.

The Glasgow Town Council on Thursday had before them two proposals which, though not directly relating to the gas undertaking, may have an important bearing upon its working. The first was a motion by Mr. Miller for a remit to the Standing Orders Committee to consider and report on the advisability of adding a new Standing Order to the effect that the Corporation Chemist should test all materials supplied by contract to the various departments, that any contractor who supplied adulterated materials should have his name and address put on the minutes, and that any contractor found guilty of such conduct on two occasions should be debarred from any further contracts. The Corporation agreed to make the remit. The motion, as expressed, does not commend itself. It seems to imply that the Corporation can confer power upon their Chemist to "find guilty" any contractor who he may consider is supplying adulterated goods. This is quite erroneous. The Corporation may, if they have it reported to them that a certain contractor's goods are not satisfactory, refuse to deal with him, or they may institute a prosecution against him before the authority appointed by statute to deal with such questions; but no Corporation can make "a law unto themselves." The risk which such would run would be that if the Corporation Chemist were to say the goods were bad, other two chemists could easily be found who would say they were quite conformable to sample; and the door would at once be opened for the involving of questions of malice, over which there might be trouble. Other reasons might easily be urged against the expediency of the proposal; but, confining myself to the gas undertaking, it can only be described as altogether unnecessary. In connection with the Gas Department there is a very efficient chemical service, who analyze not only the goods coming in, but the products from them, and are thus a double safeguard to the community. Apparently the intention is to ignore, if not to supersede, this service—a course which would only end in creating friction, and which would certainly do no good to any department or official. The Standing Orders Committee are not likely to adopt a proposal which, as presented, is both devoid of benefits and fraught with dangers. The other matter was a motion by Mr. Boyd, to the effect that the practice of permitting overtime in all Corporation departments, where the

SPIRAL GUIDED GASHOLDERS

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same could be avoided, be discontinued, and extra hands or a night shift be employed to overtake the work, should the same be necessary. The object of this crude motion, it was explained, was to give more employment to a greater number of ratepayers. Mr. Bruce Murray pointed out that the Conveners of the Committees who would be affected were absent, and, in his opinion, circumstances might arise where such a resolution would be a great inconvenience, and perhaps impair the efficiency of the department. He moved the previous question. After discussion, the motion was carried by 23 votes to 17; but, subsequently, the Council, by 21 votes to 18, remitted the subject to the various Committees for consideration. So that a hard-and-fast rule, which was almost made law by a snatch vote, has not yet been adopted—and most probably never will be.

Last night a meeting of ratepayers in Falkirk was held, to enable Mr. H. Russell, who is about to retire from the convenership of the Gas Committee, to make a statement as to the position of the gas undertaking. Mr. Russell, in the course of his statement, made a number of allegations, among which were these—that the plans of the new gas-works were passed without being looked at, which was due to the fact that there was not a man in the Town Council who had a knowledge of gas-works and their details, and that no sooner was the first contract begun than to him it was as clear as noonday that they had made a grievous mistake, and that they had simply begun to squander money by hundreds of pounds. Mr. Russell claimed that his statement regarding the cost of boilers for the new works (a difference of opinion upon which is the cause of his retirement) was correct, and had been verified by the firm who tendered for them; and he also argued that the boilers were not necessary in the gas-works. He further said that he was against that meeting being held, as he believed it would not serve any good purpose. A vote of renewed confidence in Mr. Russell was unanimously agreed to. Mr. Russell was right in thinking the meeting could do no good. He seems to regard himself as the only man in Falkirk who is able to supervise the erection of the new gas-works; forgetting that the Corporation have a capable and experienced Engineer in charge of the work. It is fair to say that in the Council Mr. Russell stands alone in holding this opinion. His continuance in the convenership is, therefore, an impossibility.

In connection with the alleged theft of coal belonging to the Corporation Gas-Works at Falkirk, the police have arrested another young man, a clerk named John Fraser; the charge against whom is similar to that which was preferred a week ago against the other man—that of being concerned in the theft of 93 tons 4 cwt. of coal from the goods station at Grahamston, the coal being the property of the Falkirk Town Council. Fraser has been liberated upon bail, fixed at £25, pending the charge being preferred before the sheriff of the county.

At the Broughty Ferry Town Council on Monday, a forecast of the gas accounts for the year ending the 15th inst. was submitted; and it is a pleasure to read that the result was considered to be satisfactory, as presenting a brighter outlook for the consumers. Provost Gray and Mr. Crystal, the Gas Convener, were requested to draw up a statement of the financial position, to be submitted to the Secretary for Scotland, with a view to obtaining guidance as to the course to be adopted to bring their gas finances into order.

Another forecast comes from Dundee; but it is not a very reliable one. It is to the effect that the officials in the Corporation Gas Department have so far made up the balance-sheet for the year now expired that they have ascertained that the consumption of gas has been far below the estimated figure. To account for this state of matters, it is recounted that the two principal railway stations are now lighted by electricity, and that the consumption of gas has been affected by the closing of the public-houses an hour earlier. On the other hand, the revenue from other sources has been better than was calculated.

The Peterhead Town Council this week had a long wrangle over the matter of the payment of the Gas Treasurer for the negotiation of loans. About three months ago, it was discovered that the Treasurer had credited himself with about £34 for this work; and the Council, on the spur of the moment, passed a resolution to the effect that he be called upon to refund the money. A letter asking him to do so was sent to the Treasurer, who remonstrated at the resolution, and explained to the Committee how matters stood, with so much effect that the Council, at their next meeting, agreed to allow him to retain what he had charged. It was sought to have this resolution rescinded, upon technical grounds; but after a long discussion, the Council, by seven votes to four, adhered to their last decision to pay the money. The question of the Treasurer's remuneration is under consideration. At present he is paid about £40 a year; and as he handles £15,000 annually, there is room for consideration. It being necessary to negotiate certain financial items at present, the Council authorized the Treasurer to do so, on the footing that he will be remunerated for his labour in proportion to any increase of salary which may be granted to him, or, failing agreement to this effect, that his remuneration shall be fixed without prejudice to any right he may otherwise have to charge for obtaining the loans.

The New Works of the Hastings Gas Company.—Correspondence has taken place between the Town Clerk of Hastings and Mr. A. E. Young, the Secretary of the Gas Company, with reference to the quantity of coal being carbonized at the new works at Glyne Gap; there being a provision in the Company's Act of 1899 that a reduction is to be made in the standard price of gas when the greater portion of the gas made is manufactured there. Mr. Young stated that the work being carried on at Glyne Gap was purely experimental—for the purpose of testing the plant, mains, &c. On it being pointed out in the Town Council that during the past six months there had been a very great falling off in the amount of coal brought into the borough, where the old works are situated, Dr. Gray said a large quantity of coal had been kept in store at Glyne Gap that had not been used. At one period, for a few days, they actually carbonized there the whole of the gas supplied to the town, for the purpose of ascertaining whether the works were able to do this; but since the end of April Glyne Gap had been absolutely shut down. He added that, as soon as alterations were completed, and they commenced regular work there, they would carbonize practically the whole of the coal at Glyne Gap.

SEASON 1905.

TAKING LINES WITH GAS COMPANIES.

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LONDON AND GLASGOW

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CURRENT SALES OF GAS PRODUCTS.

Week ending May 13.

There is not much change to record in the London market. Pitch has been in good demand; 33s. having again been obtained for fair quantities, and very slightly under this figure for important business for near delivery. This may be looked upon as satisfactory, as small second-hand parcels have been offered at lower prices, apparently to depress the market. There is some obscurity about the position of crude carbolic, as while it is admitted that 1s. 9¾d. net has been paid for sixties, and that 1s. 10d. net has been bid and refused on this market, it is at the same time asserted that consumers will not pay even the former figure. This article may, however, be looked upon as firm. The same may be said of crystal carbolic acid, as although the quantities inquired for are small at the moment, prices may be called 6d. for 35° and 6½d. for 39-40° for small parcels. There has been more movement in anthracene; and although the actual price paid cannot be disclosed, business has without doubt been done at over 1⅝d. per unit for 40-45 per cent. quality and for a satisfactory quantity. Both ordinary and liquid creosote remain steady at previous quotations. 90 per cent. benzol is fairly steady at 8¾d. net for good makes. Sulphate of ammonia, in spite of all efforts to depress it, has remained wonderfully buoyant, and is somewhat firmer than last week. The Beckton quotation is at the least £12 16s. 3d.; and this is strengthened by the report that Leith will not accept this figure.

Sulphate of Ammonia. LIVERPOOL, *May* 13.

There has been keen competition for all ready parcels offered, and at the close a slight advance is being paid. Buyers have dallied rather too long, encouraged thereto by speculative offering of summer months at a decline on prompt prices; and with only summer production to draw upon, some difficulty is being experienced in covering current requirements. The closing quotations are £12 11s. 3d. per ton f.o.b. Hull, £12 15s. per ton f.o.b. Liverpool, and £12 16s. 3d. per ton f.o.b. Leith. May prices are also being paid for early June delivery. Sales are still being made on the Continent for June-August and July-September delivery, at the equivalent of £12 7s. 6d. per ton; but makers will not accept the price. About £12 5s. is being offered for July-September; but this price does not attract first hand sellers.

Nitrate of Soda.

This article is steady on spot at 11s. 1½d. to 11s. 4½d. per cwt., according to quality, but the forward position has become decidedly quieter.

Tar Products. LONDON, *May* 13.

Business has been rather quiet during the past week, although there has been a fairly good inquiry. In benzol, prices have rather a downward tendency. Buyers decline to pay 8¾d. for prompt; while sellers are reported to have refused 8¾d. f.o.b. London, although in the North 8d. has been accepted for early shipment. As regards 50-90 per cent., there is not much inquiry; but prices are nominally from 7½d. to 8d., according to position and port of shipment. The demand for toluol for export still continues very good, and London makers are reported to have declined 8d. in more than one instance. The demand for special qualities of solvent naphtha with a high flashing point continues very good, and there is really very little offering. Ordinary 90 per cent. at 160° continues quiet, although a small business has been done during the past week for home consumption, but at low prices. There is nothing fresh to advise in anthracene. Consumers appear to be well supplied for some time to come; and just at present there does not seem much chance of any business being done for forward delivery, as the low prices which are offered by consumers certainly would not tempt any tar distiller to sell far ahead. In creosote, further sales have been made in Yorkshire at 1¼d. for May-June delivery; and in the Lancashire district 1⅛d. is reported to have been accepted in more than one instance. In London, the largest producers are still firm in their ideas—doubtless owing to the fact that shipment of a considerable quantity is now being arranged in bulk; and this will obviate the necessity of securing barrels, which has lately been the great difficulty as regards accepting business for export. Prices remain fairly steady for carbolic acid; but there does not seem such a strong demand for crude, although in crystals prices show a decided improvement. Sales of 60's crude have been made in the North at 1s. 9½d. for May-June shipment; but consumers at present decline to pay 1s. 10d., which price is asked for early delivery by most manufacturers, although they decline to offer for July-December even at this figure. In crystals, English manufacturers are now asking 6½d. in several instances; but German producers have accepted 6¼d. in more than one case for 39-40 per cent. It is rather difficult to fix the actual value for forward delivery, as makers do not seem at all anxious to sell. In pitch, the market is decidedly quiet, and during the past week there has been rather more offering, especially in the provinces. A large contract is reported to have been passed with consumers in South Wales for delivery up to the end of the present year at a rather lower price than has recently been accepted; and so far as this market is concerned there does not now appear to be any demand for early delivery. In Belgium, there is really no business doing, as the prices offered by consumers are so low that dealers decline to entertain same; while the briquette makers seem to be well supplied for early delivery. So far as the London market is concerned, there are actually sellers at 31s. to 31s. 6d., although some of the largest makers are reported still to be asking high prices for early delivery; while for next season they do not appear anxious to offer just at present.

The average values during the week were: Tar, 17s. 6d. to 21s. 6d. Pitch, London, 31s. to 31s. 6d.; east coast, 30s.; west coast, 27s. 6d. to 28s. Benzol, 90 per cent., 8½d.; 50-90 per cent., 7½d. to 8d. Toluol, 8d. Crude naphtha, 3d.; solvent naphtha, 8d. to 8½d.; heavy naphtha, 10½d. to 11d. Creosote, London, 1 5/16d. to 1⅜d.; North, 1¼d. Heavy oils, 2d. to 2 1/16d. Carbolic acid, 60 per cent., 1s. 9¼d. to 1s. 10d. Refined naphthalene, £4 to £8; salts, 12s. to 14s. Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

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Sulphate of Ammonia.

Markets have been fairly steady during the past week; and although there has not been very much business done, yet there seem to have been considerable inquiries, especially for prompt. The Gaslight and Coke Company still ask £12 16s. 3d. Beckton May-June shipment; and it is pretty generally believed they could realize very nearly this price if they were desirous of selling. The South Metropolitan still quote £13; but no business has been done at this figure. In Hull, the demand is not so good, evidently owing to the fact that there are no steamers for Spain from this port during the present month. Business has been done at £12 10s., which may be taken as about the price for May-June. Business is reported in Leith at £12 15s., although some makers are asking £12 16s. 3d. in any position. In Liverpool, the demand is very strong, owing to there being very favourable opportunities for shipment from this port during the present month.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Yearly contracts are now being concluded for coal in various directions. Contracts with the Manchester Corporation were to be tendered on Wednesday last; and these no doubt will be made semi-public in a short time. The shipping trade continues steady. The average quotations are as follow: House coal, best, 12s. to 13s., though for superior qualities as much as 14s. 6d. and 15s. is obtained, secondary 12s. to 15s., common 9s. to 10s., forge coal 8s. to 9s., best steam qualities 8s. to 8s. 6d., slack 7s. to 7s. 6d., medium 6s. to 6s. 6d., common 5s. to 5s. 6d. With regard to some of the long contracts now being concluded, there has been severe competition, so much so that there are successful collieries who find ordinary business sufficiently remunerative to enable them to do without tendering at all for corporation contracts, although it is always a strong feature in such contracts that the money is collected without difficulty.

Northern Coal Trade.

There is now more activity in the coal trade of the North, and the shipments are larger, as is customary when the Baltic trade has begun in earnest. The collieries that export a large part of their production are now much better employed, though some of the inland pits are not quite so well able to work fully as they were. In steam coals, best Northumbrians are quoted from 9s. 4½d. to 9s. 6d. per ton f.o.b., second-class steams are 8s. 3d. to 8s. 6d. per ton, and steam smalls are from 4s. 6d. to 5s. 6d. f.o.b., according to quality. Manufacturing coals are steadier, with a larger inquiry. In the gas coal trade, the demand is less for the home consumers; but increased exports are known. For occasional cargoes, the price varies from about 7s. 9d. to 8s. 3d. per ton, according to quality. There have been also one or two contracts settled for gas coals; but the price is much about the same as that of the contracts that they are intended to replace, so that the details of the exact quantities are not quite of so much interest. The coke trade is generally firm. Gas coke, being now in more limited production, and having some export demand, is firmer in the market, but the f.o.b. quotation is exactly as last given.

Scotch Coal Trade.

There is an appearance of improvement in the coal market, which is what is to be expected at this season, when the Baltic trade is opening. Orders for shipment are reported to be better than they have been for a while, the demand being greatest for ell and splint. The quotations are: Main 7s. 3d. to 7s. 6d. per ton f.o.b. Glasgow, ell 8s. to 9s, and splint 8s. 3d. to 8s. 9d. The shipments for the week amounted to 256,272 tons—an increase of 20,509 tons upon the previous week, and of 18,818 tons upon the corresponding week of last year. For the year to date, the total shipments have been 3,913,462 tons—an increase of 294,895 tons upon the corresponding period of 1904.

TRADE NOTE.

Sugden's Shallow Regenerators.

Messrs. F. C. Sugden and Co. have had orders placed with them for shallow regenerator settings by the Cwmbran and Pontnewydd Gas Company, Limited, the Quaker's Yard Gas and Water Company, Limited, and the Howden Gas Company, Limited, and for a complete new retort-bench of similar settings by the Limavady Urban District Council. The three first named are repeat orders.

Public Lighting of Cardiff.—A conference has taken place between members of the Cardiff Electrical and Lighting Committee and the Directors of the Gas Company, with regard to the suggested conversion of street-lamps to the incandescent system. The Committee will consider the offer of the Company to alter the lamps and maintain them, and will base their decision upon a financial comparison with the cost of doing the work themselves.

Street Explosions.—On Monday evening of last week, just as many people were leaving work, a loud explosion occurred in Yorkshire Street, one of the main thoroughfares of Oldham. For some distance the footpath, under which the electric cables were laid, was lifted up; and several persons were more or less injured. On the following afternoon, at Rochdale, a man proceeded to the section electrical supply-box situated in Drake Street, with a view to doing some repairs. Immediately he opened the door of the box, there was a loud report. He was struck in the face, and hurled with great force into the middle of the road. At the infirmary, it was found that he had sustained severe injuries to the head, and was very badly burnt about the face.

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"I am glad to inform you that my Directors have decided to hand over to you a new District for fitting up Installations, and I shall be glad if you will commence this work at once."

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New Gas-Works for Tavistock.—The Tavistock Lighting, Coal, and Coke Company, Limited, have decided to construct entirely new gas-works on a fresh site. They are to have an ultimate capacity of 50 million cubic feet per annum. The complete scheme, including buildings and offices, has been designed by, and will be carried out under the superintendence of, the Company's Consulting Engineer, Mr. J. W. Buckley, Assoc.M.Inst.C.E., of Falmouth. The Directors have placed the whole of the work with Messrs. Willey and Co., Limited, of London and Exeter.

Teignmouth Gas Supply.—At a meeting of the Teignmouth District Council on the 9th inst., Mr. J. A. Gray, the Manager of the gas-works, presented his report for the year ended March 31. He pointed out that at the end of March, 1903, there was a deficit of £1283. This was considerably reduced by the working operations of the next year, when a profit of £631 was made, leaving £652. This deficit had now been extinguished, and the Gas Department commenced the current financial year's operations with a credit balance of £13. The balance-sheet showed a net profit of £790 for the year just closed. The total quantity of gas made during the twelve months was 28,548,100 cubic feet—an increase of 918,100 feet, or at the rate of 3·21 per cent. The Chairman of the Gas Committee (Mr. Banbury) congratulated Mr. Gray on the satisfactory state of things; and it was agreed that the price of gas should be reduced from 4s. to 3s. 10d. per 1000 cubic feet as from the 1st of April.

Sulphur in West Ham Gas.—At the meeting of the West Ham Corporation last Tuesday, the Highways Committee reported that the Gas Examiner (Mr. Young) had found that the gas supplied by the West Ham Gas Company on March 7 and 8 contained sulphur to the extent of 26·9 grains per 100 cubic feet, or 1·9 grains above the amount permitted. The attention of the Secretary of the Company (Mr. A. G. Snelgrove) having been called to the matter, he wrote as follows: "Our own tests on the dates mentioned have given 20·90 and 20·17 grains respectively. Since the receipt of Mr. Young's report, we have tried half of the remaining liquor, and cannot discover any mistake in our tests. On examining the apparatus at the testing-office, we found the water-line in the sulphur-test meter very low; which would make a slight difference in the test made by Mr. Young." Having considered Mr. Young's reply to the foregoing communication, the Committee decided that proceedings should be taken against the Company.

The Lighting of Devonport.—Considerable discussion took place at a meeting of the Devonport Town Council last Thursday on a proposal of the Gas Committee to lay a main in the St. Budeaux district at a cost of £250. It was urged in support of the suggestion that the Corporation were under a pledge to the district, which was added to the borough a few years ago, to provide gas lighting, and that a pledge was given twelve months since that the work should be proceeded with this spring. On the other hand, it was contended that the street in which the main was to be laid was only a back lane with very few houses, and that the late Engineer had expressed the opinion that the probable revenue would not repay the cost of the extension. The Council, by a majority of two, endorsed the action of the Committee; so that the main will now be laid. Mr. Leest, who some time ago suggested that the whole question of the lighting of the town should be considered, complained that no headway was being made in this matter. A Joint Committee of the Gas Committee and the Electric Light Committee was appointed; but they had not reported, and there was no hope of any improvement being effected before next winter. The Mayor said he hoped the Committee would shortly make a report.

The Change in the Public Lighting of London.—The following was one of the "Notes" in the Engineering Supplement to "The Times" last Wednesday: "The decision of the City of London authorities to displace electric lighting of some of the public thoroughfares under their control for that of the incandescent gas-mantle marks another step in the advance of gas against what were at one time thought the irresistible claims of electricity as an illuminant. In the arc light we have electricity in the form in which it was considered most capable of, at least, holding its own against the Welsbach mantle. It was admitted that on a purely photometric basis the electric glow lamp is, light for light, more costly than gas with an incandescent mantle; but for public lighting, the lighting of large interiors, and purposes for which large illuminating units were adaptable, the electric arc lamp was held indisputably superior to any of the adaptations of illuminating gas. This is a contention which, in face of the prevailing extension of the gas-mantle in public lighting, it now seems difficult to maintain. The saving to be effected over electricity by the adoption of the Welsbach mantle for street lighting appears to be a substantial one; and the situation generally in this respect is not one to be contemplated with satisfaction from an electrical point of view."

Price of Gas at Evesham.—At the quarterly meeting of the Evesham Town Council, Mr. Fisher moved the adoption of the minutes of the Gas Committee, who recommended reductions in the price of gas amounting to 10 per cent. discount on accounts paid within one month to consumers of under 25,000 cubic feet per quarter, and additional discounts of 5 and 10 per cent. in the case of other consumers, and also an increase of £30 per annum on the salary of the Gas Manager (Mr. P. H. Fletcher). Mr. Fisher said that during the past year the receipts from sales of gas amounted to £5062, compared with £4638 in the previous year; the increase being almost entirely due to the largely increased takings from the slot-meters. The extension of retorts during the year, which cost £962, had been paid for out of profits. The balance of the year's working (£2165) had been dealt with as follows: £487 had been written off for capital depreciation, £165 paid in interest on loans, and £696 disbursed in repayments on account of principal of loans—leaving £816 net balance. The total amount of outstanding loans was now only £4217. The works and undertaking when Mr. Fletcher was appointed twelve years ago, and now were two entirely different things; and the make of gas had more than doubled. Mr. Cox moved an amendment to the effect that the Manager's salary be not increased, and that the price of gas to small consumers be reduced to 3s. 6d. per 1000 cubic feet, with the proposed discount of 10 per cent. The amendment was, however, defeated by ten votes to five, and the Committee's recommendations were adopted.

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BELL BARN ROAD, BIRMINGHAM.

Sunderland and South Shields Water Bill.—It has been intimated by Messrs. Longden, Mann, and Longden, Solicitors to the Sunderland and South Shields Water Company, that the Company's Bill was formally withdrawn last Tuesday.

Proposed Gas Lighting of Ammanford.—A proposal having been put forward to form a Company for the purpose of supplying gas to Ammanford, the District Council were anxious to ascertain what would be the maximum charge to them for public lighting if they agreed not to oppose the establishment of gas-works in the place. A deputation therefore waited on the Council and suggested a maximum of 4s. 4d. per 1000 cubic feet; but this was subsequently, at the instance of the Council, altered to 4s. 3d. A resolution pledging the Council not to oppose the scheme was carried unanimously; and the erection of the works will be at once proceeded with.

The Carron Company have lately had a very successful exhibition of gas appliances at Alston, Cumberland, under the auspices of the Alston Gas Company.

The Western Valleys Gas Company, whose works are at Pontymister, have placed orders with Messrs. Robert Dempster and Sons, Limited, of Elland, for a steel tank 51 ft. 6 in. diameter and 15 ft. 6 in. deep, together with a two-lift gasholder, and for a new bench of Waddell's patent regenerators, purifiers on Green's system, and a station governor. The work is to be carried out under the supervision of the Company's Manager, Mr. Guy S. Davies.

At the annual meeting of the Liverpool Gas-Fittings Company, Limited, last Wednesday, the Directors, in submitting the statement of accounts for the year ended the 31st of March, stated that the net profit was £1657, which together with the balance brought forward left the sum of £1749 to the credit of the profit and loss account. They recommended a dividend of 10 per cent., with a bonus of 1s. per share (free of income tax). This would leave a balance of £249 11s. 7d. to be carried forward.

Under the title of Forbes and British Pure Acetylene Gas Company, Limited, a Company has been registered with a capital of £200,000, in £1 shares, to acquire and amalgamate the business carried on by Sir Charles Stuart Forbes, Bart., the Hon. R. Leigh, and H. Graham, at Knightsbridge and Kensal Green, London, as the Forbes Acetylene Gas Company, and the business carried on in Westminster as the British Pure Acetylene Gas Company, Limited; to adopt agreements with the vendors; and to conduct the business of manufacturers and suppliers of acetylene gas, &c.

The report of Messrs. Fletcher, Russell, and Co., Limited, for the year ending Feb. 28 shows that during the year the ordinary shares were converted from £10 to £1 each. After meeting debenture interest and the 6 per cent. cumulative preference dividend, and also an interim dividend on the ordinary shares at the rate of 10 per cent. per annum, there is a surplus of £10,625, out of which the Directors recommend a final dividend at the rate of 10 per cent. per annum and a bonus of 1s. per share; making 15 per cent. for the year on the ordinary shares. The reserve fund stands at £35,434; and £2357 is carried forward.

At the ordinary general meeting of Meters Limited, to be held in Manchester on the 23rd inst., the Directors will report that the trading resulted in a gross profit of £38,027. After providing for interest on debenture stock, the net profit amounts to £27,288, which with £2672 brought forward makes £29 960, out of which interim dividends at the rate of 5½ per cent. per annum upon the preference shares, and at the rate of 5 per cent. per annum upon the ordinary shares, were paid in November last. The Directors now recommend that further dividends at the rates of 5½ and 7½ per cent. per annum respectively be now paid (making the ordinary dividend 6 per cent. for the year); and that £10,000 be added to the reserve fund, making it £45,000.

The first six months' working of the Nantwich gas undertaking under the Urban District Council has proved exceedingly satisfactory; and now an additional impetus has been given to the business by the holding of a successful exhibition, the whole of the arrangements in regard to which have been carried out by the Gas Manager (Mr. D. H. Davies). The exhibition was opened by Mr. C. E. Davenport, who was the first Chairman of the Gas Committee, who said that the profits on the works for the past six months not only met all the expenses (including the payment on interest and loan account), but left the substantial balance of £800 to be carried forward. The exhibition was arranged in conjunction with Messrs. Fletcher, Russell, and Co.; and Mrs. H. M. Young lectured daily.

At the exhibition of modern gas appliances at the Ripon Hall, Hull, which has been arranged by the Sutton, Southcoates, and Drypool Gas Company, and is being largely attended, Mr. John Holliday, F.C.S., the Company's Engineer and Manager, gave last Thursday an interesting lecture on "Gas-Burners: Their Modern Development." He dwelt on the unsatisfactory results obtained by using old burners; and pointed out that by a judicious selection of the appliances available, many pounds might be saved annually wherever gas was in use. All burners required attention, and it was a great mistake to think that a gas-burner put up once was to be regarded as a permanent fixture. No greater fallacy could be conceived. Comparing gas with electricity, Mr. Holliday pointed out that for street lighting the sphere of usefulness of the arc lamp was ended. One of the chief drawbacks of the Nernst lamp, as they had found out in East Hull, was the time occupied in the lamp becoming incandescent, and it was a very costly type of lamp to maintain. As to the cost, it was ten to one in favour of gas. Turning to the use of gas for culinary purposes, the lecturer said the gas-cooker in connection with the penny-in-the-slot meter was becoming very general in East Hull—a fact that was not to be wondered at when they took its advantages into consideration, for it saved a deal of work and trouble. In concluding, Mr. Holliday dealt with the advantages of gas for heating purposes and also for motive power; and said that if they decided to use electricity for power or light, he would recommend the employment of a gas-engine to drive the dynamos. Mr. Holliday was heartily thanked for his lecture.

THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and Cannot be tampered with through the Slot.

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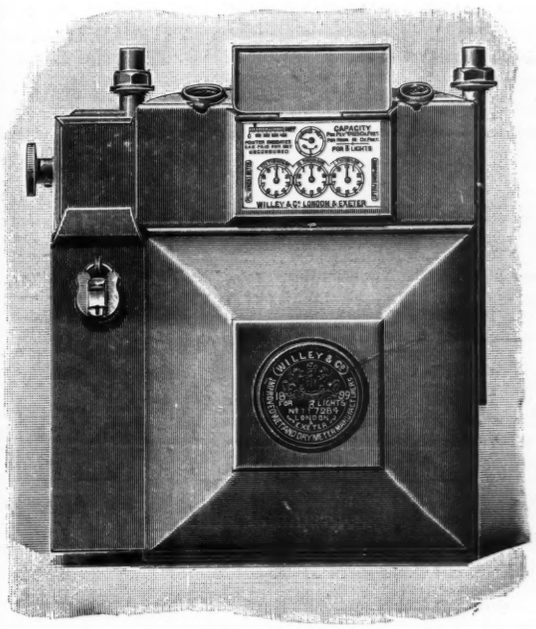
3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.



ALL PARTS INTERCHANGEABLE.

Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LTD., LONDON & EXETER.

WANTED, FOR SALE, CONTRACT, &c. ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.
WORKING MANAGER. No. 4388.
SALESMAN FOR SHOW ROOMS. Bath Gas Company. Applications by May 23.
GAS-FITTER. No. 4391.
INTERVIEWER, &c. No. 4392.
JUNIOR CHEMIST. Birmingham Gas Department. Applications by May 23.
SUB-MANAGER. Warrington Gas Department. Applications by June 8.

Situations Wanted.
ASSISTANT MANAGER OR SUPERINTENDENT. No. 4390.
GAS-FITTER, &c. Gibson, Wellingborough.
ENGINE FITTER, DRAUGHTSMAN, &c. Fitter, Moston, Manchester.
MAIN AND SERVICE LAYER. Moat, Pontefract.

Investment Wanted. Gould's Advertising Offices.

Plant, &c., for Sale.
CONDENSER. Redditch Gas Company.
PURIFIERS, &c. Brechin Gas Company.

Stocks and Shares.
GAS METER COMPANY.
ILFORD GAS COMPANY. May 23.
TENDRING HUNDRED WATER COMPANY. May 23.

TENDERS FOR

Benzol.
WARRINGTON GAS DEPARTMENT. Tenders by June 1.

Brass and Copper Tubing and Fittings, Lead Pipe, &c.
WARRINGTON GAS DEPARTMENT. Tenders by June 1.

Coal and Cannel.
BARNOLDSWICK GAS DEPARTMENT. Tenders by May 29.
BRIGHOUSE GAS DEPARTMENT. Tenders by May 26.
CLITHEROE GAS DEPARTMENT. Tenders by May 27.
CONGLETON GAS DEPARTMENT. Tenders by June 3.
DOWNHAM MARKET GAS COMPANY. Tenders by May 20.
FARNHAM GAS COMPANY. Tenders by June 3.
GLOUCESTER GASLIGHT COMPANY. Tenders by May 27.
HEREFORD GAS DEPARTMENT. Tenders by June 3.
LEEK GAS DEPARTMENT. Tenders by May 29.
MANSFIELD GAS DEPARTMENT. Tenders by May 29.
NEWRY GAS DEPARTMENT. Tenders by June 2.
PAIGNTON GAS COMPANY. Tenders by June 10.
RICKMANSWORTH GAS DEPARTMENT. Tenders by May 30.
SKIPTON GAS DEPARTMENT. Tenders by May 27.
SMETHWICK GAS DEPARTMENT. Tenders by May 26.
SOWERBY BRIDGE GAS DEPARTMENT. Tenders by May 29.
SWADLINCOTE GAS DEPARTMENT. Tenders by May 31.
TORQUAY GAS DEPARTMENT. Tenders by May 23.
WARE GAS COMPANY. Tenders by June 5.
WARRINGTON GAS DEPARTMENT. Tenders by June 1.
WIRKSWORTH GAS COMPANY. Tenders by June 5.

Cookers.
WARRINGTON GAS DEPARTMENT.

Fire Clay Goods.
WARRINGTON GAS DEPARTMENT.

General Stores, Oils, Paints, &c., &c.
WARRINGTON GAS DEPARTMENT.

Lamps.
WARRINGTON GAS DEPARTMENT.

Lime.
CONGLETON GAS DEPARTMENT. Tenders by June 3.
SWADLINCOTE GAS DEPARTMENT. Tenders for May 31
WARRINGTON GAS DEPARTMENT.

Meters (Ordinary and Slot).
SMETHWICK GAS DEPARTMENT. Tenders by May 26.
WARRINGTON GAS DEPARTMENT.

Pipe Laying.
SHEPPY GAS COMPANY. Tenders by May 24.

Pipes and Fittings.
WARRINGTON GAS DEPARTMENT.

Purifier Covers.
TEIGNMOUTH GAS COMPANY. Tenders by May 27.

Retort Fittings, &c.
SWADLINCOTE GAS DEPARTMENT. Tenders by May 31.

Sulphate Plant.
MILLOM GAS DEPARTMENT. Tenders by May 24.
WARRINGTON GAS DEPARTMENT. Tenders by June 1.

Tar and Liquor.
ACCRINGTON GAS AND WATER BOARD. Tenders by June 6.
CONGLETON GAS DEPARTMENT. Tenders by June 3.
EXMOUTH GAS COMPANY. Tenders by May 23.
LEEK GAS DEPARTMENT. Tenders by May 29.
MANSFIELD GAS DEPARTMENT. Tenders by May 29.
WIRKSWORTH GAS COMPANY. Tenders by June 5.

Well Sinking, &c.
BARNET GAS AND WATER COMPANY. Tenders by June 2.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."
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All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE for Gas Purification.
Largest Sale of any Oxide.
SPENT OXIDE purchased in any district.
GAS PURIFICATION & CHEMICAL CO., LD.
JOHN WM. O'NEILL, Managing Director,
PALMERSTON HOUSE, LONDON, E.C.

WINKELMANN'S

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO, LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
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SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
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PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
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SPENT OXIDE PURCHASED IN ANY DISTRICT.

THE First Dutch Bogore Co., Ltd.,
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CHARGING MACHINERY—See Advt. in last week's issue.
SATURATORS—See Advt. in this week's issue.
EXHAUSTING MACHINERY—See Advt. in next week's issue.

JOHN RILEY & SONS, Chemical Manu- facturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

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BALE & CHURCH will be pleased to send Quotations and Samples on application.
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BALE'S FIRE CEMENT for all Retort and Furnace work.
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SPECIALLY prepared for the Manu- facture of SULPHATE OF AMMONIA.
SPENCER, CHAPMAN, AND MESSEL, LIMITED, 36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341, AVENUE.

ATTERTON'S Patent Charging Machine, especially adapted for Small Works up to 50 Millions. Nearly 40 already supplied, and still supplying. Would soon repay for small outlay. Increased make and reduction in cost.
Apply to E. PADFIELD AND CO., 96 & 98, Leadenhall Street, LONDON, E.C.

SPENT OXIDE.

THE South Metropolitan Gas Company are always open to receive OFFERS of SPENT OXIDE.
Chief Office: 709, Old Kent Road, London, S.E.
Telegrams: "METROGAS, LONDON."

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

GASHOLDER PAINTING.

PAINTING Work for all kinds of Gas- Works Plant undertaken by contract or otherwise.
FREDERICK BOYALL, 31, Regent's Row, Queen's Road, DALSTON, N.E. Established 1850.

YOUNG Man wants situation as Gas FITTER. Five Years' Experience at Gas-Works. Used to Iron and Compo. Had considerable Experience in Slot Installations, Incandescents, &c. Age 21.
Address J. W. GIBSON, Gas Cottages, London Road, Wellingborough, NORTHANTS.

ROBERT DEMPSTER & SONS, Ltd., Contractor for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

WANTED, Situation as Main and SERVICE LAYER, &c., or the Management of small works. Well up in the Manufacture and Distribution of Coal Gas. Age 26. Well recommended.
Address GEO. MOAT, junr., Gas-Works, Featherstone, PONTEFRACT.

SITUATION wanted by an Engine FITTER. Young and Active, Nine Year's Practical Experience; also Technical Training. Good Draughtsman. Could take Entire Charge of Power Plant, &c.
Address FITTER, 37, Gladys Street, Lightbourne Road, Moston, MANCHESTER.

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A WELL-QUALIFIED and Competent Engineer requires Situation as ASSISTANT MANAGER or SUPERINTENDENT of Gas-Works, or would manage small works. Has had excellent Training and Experience in all departments of Manufacture. For some years has been Superintendent of Works of 3 Millions daily capacity; is a very good Draughtsman; and able to prepare Designs for Alterations, Extensions, Machinery, &c. First-Class References and excellent Testimonials would be supplied.
Address, No. 4390, care of Mr. King, 11, Bolt Court FLEET STREET, E.C.

GAS FITTER Wanted. Age not exceeding 30. Must be of good address, able to lay Mains and Services, work Iron and Compo, Fix Meters, Stoves, Attend to Incandescent Fittings, and repair Works tools. Abstainer preferred. Permanent employment to suitable man. Wages 31s.
Address No. 4391, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, on Aug. 1, 1905, a thoroughly Competent and Experienced WORKING MANAGER for a Gas-Works in small Town in Midlands. Salary £150. A House is provided at the Works, with Coal and Gas.
Replies, stating Age and Experience, with not less than three recent Testimonials, to be sent before the 23rd of May to No. 4388, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Engineer of a large Gas Corporation requires Assistance in the Interviewing and Advising of parties as to the most Effective and Economical Methods of using Gas for both Lighting, Cooking, and Heating. Applicants must be thoroughly conversant with the relative costs of both Gas and Electricity for Lighting and for Power.
Apply, stating Experience, Age, and Salary expected, to No. 4392, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Bath Gaslight and Coke Company are about to open new Show-Rooms in the City, and will require the services of an Energetic, Properly-Qualified SALESMAN, with good knowledge of the most Modern and Approved Methods of using Gas for Lighting, Heating, Cooking, &c,
Applications, stating Age, Experience, &c., Salary required, and enclosing *copies* of three Testimonials, to be sent in by the 23rd inst.
C. STAFFORD ELLERY,
Manager.

CITY OF BIRMINGHAM.
(GAS DEPARTMENT.)

THE Gas Committee require the services of a JUNIOR CHEMIST. Age from 18 to 22. Commencing Salary £50 to £65 per annum, according to qualifications.
Applications to be forwarded to the undersigned on or before the 23rd inst.
W. B. DAVIDSON,
Chief Chemist.
Saltley Gas-Works,
Birmingham, May 13, 1905.

COUNTY BOROUGH OF WARRINGTON.

THE Gas Committee of the above Borough require the services of a SUB-MANAGER for their Longford Gas Station.
Salary, £150 per annum.
Full Particulars can be obtained from Mr. W. S. Haddock, the Gas Engineer.
Applications, accompanied by Three recent Testimonials, addressed to the Chairman of the Gas Committee, Mersey Street, Warrington, must be sent in not later than the 8th of June next.
Canvassing will be a disqualification.
FREDK. TAYLOR,
Secretary.
Gas Offices, Warrington,
May 13, 1905.

A GENTLEMAN with many Years Business Experience seeks an INVESTMENT in either Brewery, Gas, Water, Railway, or Tramway Company, where a large holding in Preference or Debenture Shares would secure a seat on the Board of Direction.
Write "GENUINE," care of Gould's Advertising Agency, 54, NEW OXFORD STREET, W.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters. Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

THE
Institution
OF
Gas Engineers.

THE
ANNUAL GENERAL MEETING
WILL BE HELD ON
TUESDAY (10.30 a.m.), WEDNESDAY (10 a.m.), and THURSDAY (10 a.m.)
May 30th, and 31, and June 1st,
AT THE
INSTITUTION OF MECHANICAL ENGINEERS,
STOREY'S GATE, ST. JAMES'S PARK, WESTMINSTER, S.W.,
By kind permission of the Council of that Institution.

THE CHAIR WILL BE TAKEN BY THE PRESIDENT,
DANIEL IRVING, Esq., M.Inst.C.E.

In connection with the Meeting, a Visit to Hastings has been arranged for Friday, 2nd June. Full Particulars are announced in the Programme.

THE BENEVOLENT FUND.

The Annual General Meeting of the Contributors to the Benevolent Fund will be held on Wednesday, 31st May, at 10 a.m.
WALTER T. DUNN, Secretary.
39, *Victoria Street, Westminster.*

PURIFIERS Wanted, 12 feet and 20 feet. Square Boxes. Must be Good and Cheap.
FIRTH BLAKELEY, Thornhill, DEWSBURY.

REDDITCH GAS COMPANY.

CONDENSER for Sale (water cooled), faced joints. First-Class Condition. Capacity 250,000 per day.
Particulars, &c., from A. E. LAYTON, Manager.

NEW Gasholder, 40 ft. diameter by 12 ft. deep, with Steel Standards; also new STEEL TANK to contain same.
Write J. WRIGHT, 181, Queen Victoria Street, LONDON, E.C.

TEST PLANT FOR SALE—We have several small Sets of GAS APPARATUS suitable for Test Plants, including Retorts, Condensers, Scrubber, Purifiers, Gasholders, overhauled and guaranteed, or New throughout.
FIRTH BLAKELEY AND CO., Thornhill, DEWSBURY.

PURIFIERS, &c., FOR SALE—Sets of 4 ft., 5 ft., 6 ft., 8 ft., 9 ft., 10 ft., 12 ft., 18 ft. squares; also 16 ft. by 12 ft., &c. SCRUBBERS, 8 ft. by 60 ft. 10 inch, 18 inch Square METERS. EXHAUSTERS up to 50,000 feet per hour in Stock. GASHOLDERS and TANKS, also New. State requirements
FIRTH BLAKELEY AND CO., Thornhill, DEWSBURY.

PURIFIERS FOR SALE.

THE Brechin Gas Company have Four PURIFIERS for Sale. They are being replaced by larger ones.
Two 10 ft. 9 in. square by 2 ft. 9 in.
Two 10 ft. 9 in. square by 4 ft.
Also Six 9-inch Four-way Valves, with Flanged Connections.
Offers to, and further Particulars from,
ALLAN REID,
Manager.
Gas-Works, Brechin,
May 15, 1905.

THE Rickmansworth Urban District Council invite TENDERS for good GAS COAL for the supply of their Gas-Works during the Twelve Months commencing July 1 next; the quantity being estimated at about 2400 Tons.
Delivery will be taken either by truck at Rickmansworth Station (Metropolitan or London and North Western Railways at the Council's option) or by Canal, delivered alongside the Town Wharf. In the latter case, the charge included for lighterage from ship's side in the Thames should be given.
If delivered by rail, the price should be quoted at the pit; also the rail rate and the waggon hire, which are to be allowed should the Council prefer to run their own waggons or pay their own rail rates.
Contractors must give a full description of the Coal to be supplied. Payment will be made by the end of the month following delivery.
The Coal will be taken in the proportion of about one-third during the Summer Six Months, and the remainder during the Winter; but the Council reserve the right to demand deliveries in accordance with their requirements at any time during the period covered by the Contract.
Should the Tenderer prefer doing so, Summer and Winter prices may be quoted.
The Council do not bind themselves to accept any Tender.
Forms of Tender should be obtained from the undersigned, and be returned to him, endorsed "Tender for Gas Coal," before the 30th of May.
HENRY LOMAS,
Clerk to the Rickmansworth
Urban District Council.
May 12, 1905.

FARNHAM GAS COMPANY, LIMITED.

THE Directors of the above Company invite TENDERS for the supply of 4200 Tons of good, clean fresh worked GAS COAL (screened and unscreened), delivered at Farnham Station (L. & S.W. Railway) in such quantities and at such times as required during the year ending May 31, 1906.
Forms of Tender may be obtained on application.
Tenders, endorsed "Coal," to be delivered to the undersigned not later than the 3rd of June next.
S. J. SYMONDS,
Manager and Secretary.
Gas-Works, Farnham,
May 12, 1905.

COUNTY BOROUGH OF WARRINGTON.

THE Gas Committee invite Tenders for the undermentioned GOODS.
Full Particulars can be obtained on application to Mr. W. S Haddock, Gas Engineer, Warrington.

2—Bolts and Nuts.
3—Brass and Copper Tubing.
4—Brass Fittings.
6—Cast-Iron Pipes and Connections.
8—Castings.
10—Copper Street-Lamps.
11—Cookers.
13—Fire-Bricks, Fire-Clay, and Retorts.
14—Flexible Tube.
17—Lead and Compo. Pipe.
18—Lime.
19—Oils, Paint, &c.
21—Rails, Crossings Fastens, &c.
25—Wet and Dry Gas Meters.
26—Wrought-Iron Tubes and Fittings.

FREDK. TAYLOR,
Secretary.
Gas Offices, Warrington,
May 13, 1905.

COUNTY BOROUGH OF WARRINGTON.

THE Gas Committee invite Tenders for the supply of about 30,000 Tons of COAL, SLACK, or NUTS; 6000 Tons of CANNEL; and 7000 Gallons of BENZOL for One Year.
Forms of Tender, with Specification, can be obtained on application to Mr. W. S. Haddock, the Gas Engineer, Warrington.
Also for the supply of a SULPHATE of AMMONIA STILL and HEATER for treating 30 cwt. of Liquor per hour.
Sealed Tenders, addressed to the Chairman of the Gas Committee, to be delivered to the Gas Offices in Mersey Street, Warrington, not later than the 1st of June next.
FREDK. TAYLOR,
Secretary.
Gas Offices, Warrington,
May 13, 1905.

URBAN DISTRICT COUNCIL, BOROUGH OF NEWRY.

TENDERS FOR GAS COAL.

THE Gas Committee of the above Council invite TENDERS for the supply of from 4000 to 5000 Tons of best screened GAS COAL (with quotation for unscreened Gas Coal at same time) for a period of Twelve Months, to be delivered in such quantities and at such times as may be required by the Committee, and to weigh 20 cwt. to the Ton over the Gas Committee's Weighbridge at their Works (said Machine is regularly inspected by Officer under Weights and Measures Act,) and delivered *free ex* Ship or Steamer at Albert Basin, Newry.
The Coal to be Fresh Wrought, Dry, and Free from Hards, Smudge, Dirt, Shale, Pyrites, or other objectionable matter for Gas making.
Further Particulars may be obtained from Mr. B. Gibson, Manager.
Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, and where raised, to be addressed to T. P. Ledlie, Esq., Chairman, and delivered to the undersigned not later than 10.30 a.m., on Friday, the 2nd June.
The Committee reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender. They also reserve the power to decline acceptance of any Coal not equal in their belief to that contracted for.
ROBERT H. DOHERTY,
Clerk,
Urban District Council of Newry.
New Town Hall, Newry,
May 12, 1905.

BOROUGH OF CONGLETON.

THE Gas Committee invite Tenders for the following:—

1.—GAS FUEL.

The supply of best screened GAS COAL or NUTS for Gas-Making purposes, to be delivered in sender's or Railway Company's Trucks at Brunswick Wharf, Congleton (N. S. R.), during the Twelve Months ending June 30, 1906.
Form of Tender and Conditions may be obtained from the undersigned.

2.—LIME.

The supply of about 150 Tons of best Hand-Picked LIME for Purifying purposes, to be delivered in sender's or Railway Company's Trucks at Brunswick Wharf, Congleton (N. S. R.), in such quantities and at such times as may be required during the Twelve Months ending June 30, 1906.
No Special Form required.

3.—TAR, &c.

The purchase of surplus TAR and AMMONIACAL LIQUOR for the Twelve Months ending June 30, 1906.
Forms of Tender and Conditions may be obtained from the undersigned.
Tenders, endorsed "Coal," "Lime," or "Tar" respectively, to be delivered at the Office of E. A. Plant, Esq., Town Clerk, Congleton, on or before Saturday, the 3rd day of June, 1905.
The Committee do not bind themselves to accept the lowest or any Tender.
J. SMITH,
Engineer and Manager.
Gas-Works, Congleton,
May 12, 1905.

TEIGNMOUTH URBAN COUNCIL.

(Gas Department.)

TENDERS are invited for the supply of Two new PURIFIER COVERS.

Further Particulars on application to the undersigned.

Tenders, endorsed "Purifier Covers," to be delivered to the undersigned on or before Saturday, the 27th inst.

J. Alex. Gray,
Gas Manager.

SWADLINCOTE District Urban District Council Gas Department are prepared to receive TENDERS for the supply of FITTINGS, HYDRAULIC MAINS, SELF-SEALING MOUTHPIECES, STEEL JOINTS, &c., for 28 Retorts.

Specification, Form of Tender, Schedule of Quantities, and all other Information may be obtained on application to Mr. G. B. Smedley, Engineer and General Manager.

Tenders, endorsed "Retort-Fittings," to be delivered at my Office by Twelve noon, May 31 next, 1905.

The lowest Tender not necessarily accepted.

W. A. Musson, Solicitor.
Clerk to the Council.

Gas Offices, Swadlincote,
Burton-on-Trent.

SWADLINCOTE DISTRICT URBAN DISTRICT COUNCIL.

(Gas Department.)

THE Gas Committee of the above Council are prepared to receive TENDERS for LIME.

The supply of about 150 Tons of Best Hand-Picked Buxton LIME, and about 150 Tons of LIME REFUSE, to be delivered at the Gas-Works in such quantities and at such times as may be required during the Twelve Months ending June 30, 1906.

GAS COAL.

The supply of 4000 Tons (more or less) of best screened GAS COAL, to be delivered in such quantities as may be required during the Twelve Months ending June 30, 1906.

All Particulars and Form of Tenders may be obtained from Mr. G. B. Smedley, the Engineer and Manager.

Tenders must be on the prescribed Forms and accompanied by Analysis, and must be delivered to the undersigned on or before Twelve noon, May 31, 1905, endorsed "Lime" or "Gas Coal," as the case may be.

The Council do not bind themselves to accept any Tender.

W. A. Musson,
Clerk to the Council.

Gas-Works, Swadlincote,
May 9, 1905.

WIRKSWORTH GASLIGHT AND COKE COMPANY, LIMITED.

TENDERS FOR GAS COAL AND TAR AND LIQUOR.

THE Directors of the above Company are prepared to receive TENDERS for the supply of about 800 Tons of GAS COAL, to be delivered at the Midland Railway Station, Wirksworth, in such quantities as the Manager shall from time to time direct.

Also for the purchase of the surplus TAR and LIQUOR made at their Works during the Twelve Months commencing the 1st day of July next.

The Coal must be freshly wrought and free from Sulphurous Pyrites and other Objectionable Matter.

Sealed Tenders, endorsed "Coal" or "Tar and Liquor," to be delivered to the undersigned not later than June 5, 1905.

No Form of Tender supplied.

S. Halstead,
Secretary and Manager.

Gas Offices, Derby Road,
Wirksworth, May 12, 1905.

LEEK URBAN DISTRICT COUNCIL.

TO COLLIERY PROPRIETORS AND OTHERS.

TENDERS are invited for the supply of all or part of 10,000 Tons of GAS-COAL NUTS to be delivered at the Leek Station on the North Staffordshire Railway during the Year commencing the 1st of July, 1905.

Forms of Tender and further Particulars may be obtained from the Manager at the Gas-Works or from the undersigned.

Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leek, on or before Monday, the 29th of May inst.

The lowest or any Tender will not necessarily be accepted.

By order,
C. Henshaw,
Clerk.

Town Hall, Leek,
May 13, 1905.

LEEK URBAN DISTRICT COUNCIL.

TO TAR DISTILLERS AND OTHERS.

TENDERS are invited for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at the Leek Gas-Works for One, Two, or Three Years commencing the 1st of July, 1905, at per ton of 2240 lbs. at the Works.

Forms of Tender and further Particulars may be obtained from the Manager at the Works or the undersigned.

Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leek, on or before Monday, the 29th of May inst.

The highest or any Tender will not necessarily be accepted.

By order,
C. Henshaw,
Clerk.

Town Hall, Leek,
May 13, 1905.

MILLOM URBAN DISTRICT COUNCIL.

TENDERS are invited for the Supply and Erection at the Millom Gas-Works of a SULPHATE OF AMMONIA PLANT capable of dealing with 10 Tons of Liquor per Twenty-four hours.

The Council will provide the Building, Foundations, Brick Purifier, Overhead Liquor Storage Tank, and make all Connections.

Persons tendering must submit their own Designs of Apparatus, with full detail Specification; but the work must be carried out according to the Council's general Specification, copies of which will be supplied on application.

The lowest or any Tender not necessarily accepted.

Plans, &c., with Tenders, endorsed "Sulphate Plant," to be sent to me not later than the 24th of May inst.

W. T. Lawrence,
Clerk to the Council.

Council Offices, Millom,
May 5, 1905.

PAIGNTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Paignton Gas Company are prepared to receive TENDERS for the supply of 4000 Tons about (or such other quantity as may be agreed on) of best approved GAS COALS, to be delivered in such monthly quantities as may be required by the Company.

Tenders to state the price of the Coal delivered at Paignton Station, Great Western Railway, free of all Charges.

Tender Forms are not issued.

The Directors do not bind themselves to accept the lowest or any Tender.

Further Particulars may be obtained on application to Mr. C. G. Dawson, the Company's Manager.

Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of Coal, to be sent on or before the 10th day of June, addressed to the undersigned at the Gas Offices, 1a, Victoria Street, Paignton.

F. W. Puddicombe,
Secretary.

Paignton, May 9, 1905.

SOWERBY BRIDGE URBAN DISTRICT COUNCIL.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of 14,000 Tons of best screened GAS COALS and 1200 Tons of best CANNEL COALS, or such quantities as may be required for the Gas-Works at Sowerby Bridge and Luddenden Foot during the period of Twelve Months from the 1st of June, 1905, to the 31st of May, 1906.

Tenders will be received for the whole or any portion of the above quantity.

Specifications, Forms of Tender, and all Information can be obtained on application to the Engineer, Mr. A. W. Bissell, Gas-Works, Sowerby Bridge.

The Gas Committee reserve the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Tender for Coal" or "Cannel," to be delivered not later than Twelve noon on Monday, the the 29th of May, 1905, to

R. W. Evans,
Solicitor and Clerk to the Council.

Commercial Bank Chambers,
Halifax, May 8, 1905.

MANSFIELD CORPORATION.

(Gas Department.)

TENDERS FOR GAS COAL AND CANNEL.
TENDERS FOR TAR AND AMMONIACAL LIQUOR.

Coal.

THE Gas Committee are prepared to receive TENDERS for 1500 Tons of CANNEL and 10,000 Tons of best screened GAS COAL, delivered at Mansfield Station for One Year from the 1st of June, 1905, to the 31st of May, 1906.

Tar and Liquor.

TENDERS for surplus TAR and LIQUOR made from the 1st of June, 1905, to the 31st of May, 1906. Tenders for Liquor to be made either at a fixed price per Ton or on the Sliding-Scale regulated by the price of Sulphate.

Tenders, endorsed "Coals" or "Tar and Liquor," as the case may be, to be sent to J. Harrop White, Esq., Town Clerk, Mansfield, on or before the 29th of May, 1905.

Particulars and all other Information from the undersigned.

NOTE: No Special Form of Tender provided.

The Committee do not bind themselves to accept the lowest or any Tender.

Arthur Graham,
Engineer and Manager.

Gas-Works, Mansfield,
May 5, 1905.

BARNET DISTRICT GAS AND WATER COMPANY.

TENDERS are required for Sinking a WELL and Driving ADITS at Northaw, in Hertfordshire, for the Barnet District Gas and Water Company, in accordance with plans and Specifications which can be seen at the Company's Offices, New Barnet.

Further Particulars can be obtained of the Company's Engineer and Manager, Mr. T. H. Martin, Assoc. M.Inst.C.E., and copies of the Plans and Specifications will be supplied on payment of One Guinea, to be returned on receipt of a *bona fide* Tender.

Sealed Tenders to be sent in on or before Ten a.m. on Friday, June 2, 1905, addressed to the Chairman of the Company, 30, Gracechurch Street, London, E.C.

The Directors do not bind themselves to accept the lowest or any Tender.

T. H. Martin, Assoc. M.Inst.C.E.,
Engineer and Manager.

Station Road, New Barnet,
May 5, 1905.

BOROUGH OF CLITHEROE.

(Gas Department.)

TENDER FOR GAS COALS.

THE Gas Committee invite Tenders for screened GAS COAL, NUTS, SLACK, and CANNEL to be delivered at the Gas-Works Siding during the Year ending June 30, 1906.

Particulars and Forms of Tender may be obtained from the undersigned.

Sealed Tenders, endorsed "Tender for Gas Coal," addressed to the Chairman of the Gas Committee, to be delivered at my Office on or before Saturday, the 27th of May, 1905.

Robt. Barrett,
Manager.

Gas-Works, Clitheroe,
May 9, 1905.

SHEPPY GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for laying about 7000 Yards of 10-inch diameter and 8-inch diameter Cast-Iron GAS-MAINS.

Full Particulars may be obtained at this Office on and after the 10th of May, 1905, on deposit of 21s., which will not be returned except on receipt of a *bonâ-fide* Tender.

Tenders to be addressed to the Chairman of the Sheppy Gas Company, Sheerness-on-Sea, Kent, endorsed "Tenders for Mainlaying," and must be delivered not later than the 24th day of May, 1905.

The Sheppy Gas Company do not bind themselves to accept the lowest or any Tender.

H. Barber,
Secretary and Manager.

Offices: 2, Trinity Road,
Sheerness-on-Sea.

BOROUGH OF TORQUAY.

THE Gas-Works Committee of the Torquay Town Council are prepared to receive TENDERS for the supply of 3000 Tons of approved GAS COAL, delivered free into Stores at the St. Mary Church Gas-Works.

Further Particulars may be had from the Engineer (Mr. F. Chalmers), and Forms on which Tenders must be submitted may be obtained at my Office, Town Hall, Torquay.

Sealed Tenders, endorsed "Tenders for Gas Coals," to be sent to the undersigned not later than Nine a.m. on Tuesday, the 23rd of May, 1905, addressed Town Hall, St. Mary Church, Torquay.

The lowest or any Tender will not necessarily be accepted.

Fredk. S. Hex,
Town Clerk.

May, 1905.

SKIPTON URBAN DISTRICT COUNCIL.

TENDERS FOR GAS COAL.

THE Council invite Tenders for the Supply of about 7000 Tons of Best GAS COAL (Screened, Unscreened, and Nuts), to be delivered free at the Railway Station, Skipton, or at the Council's Wharf adjoining the Gas-Works in Skipton, on the Leeds and Liverpool Canal, between June 30, 1905, and July 1, 1906, in monthly quantities.

Full Particulars as to Periods and Quantities of Deliveries, &c., and Form of Tender, may be obtained from the Manager (Mr. J. H. Woodward, Gas-Works, Skipton), and Tenders, endorsed "Tender for Coal," are to be sent to the Chairman of the Gas Committee Gas-Works, Skipton, on or before Saturday, May 27 1905.

The lowest or any Tender not necessarily accepted.

Richard Wilson,
Clerk to the Council.

May 5, 1905.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 33,000 Tons of GAS COAL for One Year from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Sidings, Hempstead, near Gloucester, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by Water, the price f.o.b., and also the price delivered at the Gas Company's Wharf on the Gloucester and Berkeley Canal.

Further Particulars and Forms of Tender may be obtained of the undersigned.

Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than Saturday, the 27th inst.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender.

By order,
William E. Vinson,
Secretary.

Gas Offices, Gloucester,
May 1, 1905.

TENDER FOR TAR.

THE Directors of the Exmouth Gas Company invite TENDERS for their surplus TAR for Twelve Months from the 1st of June next, at per Ton of 200 Gallons delivered into Contractor's Tanks at the L. & S.W. Railway Company's Sidings, Exmouth Station.

Sealed Tenders, endorsed "Tender for Tar," will be received by the undersigned on or before Tuesday, the 23rd inst.

The Directors do not bind themselves to accept the highest or any Tender.

By order,
James T. Foster,
Secretary and Manager.

Gas-Works,
May 4, 1905.

THE Ware Gaslight, Coal, and Coke Company, Limited, invite TENDERS for the supply of from 1800 to 2000 Tons of East Pontop, Barrow, Norfolk, or Strafford Silkstone or Aldwarke Main unscreened GAS COAL for the Year ending the 24th day of June, 1906.

Particulars may be obtained of the undersigned.

Sealed Tenders to be delivered to me on or before the 5th day of June prox.

The lowest Tender will not necessarily be accepted.

Dated this 9th day of May, 1905.

GEO. H. GISBY,
Secretary.

Ware, Herts.

DOWNHAM MARKET GAS AND COKE COMPANY, LIMITED.

THE Directors of the above Company invite TENDERS for the supply of about 700 Tons of screened GAS COAL or NUTS, to be delivered at the Gas-Works Siding, Downham Market, by the end of June, 1906, in such quantities as may from time to time be determined by the Company's Engineer.

Tenders, endorsed "Coal," to be sent to the undersigned not later than the 20th of May, 1905.

The Directors do not bind themselves to accept the lowest or any Tender.

JOHN S. PARROTT,
Secretary.

Downham Market, May 8, 1905.

BOROUGH OF BRIGHOUSE.

GAS COAL, &c.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of GAS COAL, SCREENED NUTS, CANNEL, and BUXTON LIME, required by them during the year ending June 30, 1906.

Specification and Form of Tender can be obtained on application to the Gas Engineer's office, Mill Lane, Brighouse.

Sealed Tenders to be sent in on or before Friday, the 26th day of May, 1905, addressed to the Town Clerk, Municipal Offices, Brighouse, endorsed on the outside "Tender for Coal," or "Lime," as the case may be.

JAMES PARKINSON,
Town Clerk.

Town Clerk's Office,
Brighouse, May 8, 1905.

ACCRINGTON DISTRICT GAS AND WATER BOARD.

THIS Board invites Tenders for the surplus TAR and AMMONIACAL LIQUOR, which may be produced at the Accrington and Great Harwood Works of the Board, during the Year from July 1 next to June 30, 1906. The estimated quantity of Tar is 2000 Tons and Liquor 5000 Tons.

Sealed Tenders, endorsed "Tar and Liquor," addressed to the Chairman of the Board, must be in my hands on or before Tuesday, June 6.

Forms of Tender may be obtained on application.

By order,
CHARLES HARRISON,
General Manager.

General Offices, Accrington,
May 12, 1905.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

MR. ALFRED RICHARDS has for Sale 30 £10 SHARES in the GAS METER COMPANY, LIMITED, at £25 per Share. At this price, the return to the buyer would be 6 per cent. on the basis of last Year's dividend and bonus, which together were equal to (and have not been less for the last 14 years than) 15 per cent.

The Company are doing a large business both in England and the Colonies, and the increased use of Slot Meters all over the World causes a continuing demand for such Meters. The Gas Meter Company supply the principal London Companies as well as the Local Companies round London and in the Provinces.

Apply to Mr. ALFRED RICHARDS, Auctioneer, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ILFORD GAS COMPANY.

NEW ISSUE OF £10,000 ORDINARY "C" STOCK AND £5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 23, at Two o'clock in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
TENDRING HUNDRED WATER-WORKS COMPANY.
(Supplying Harwich, Dovercourt, Walton-on-Naze, and Frinton-on-Sea.)

NEW ISSUE OF 800 £10 "A" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 23, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

BARNOLDSWICK URBAN DISTRICT COUNCIL.
(GAS AND WATER DEPARTMENT.)

THE above Council invite Tenders for the supply of 3200 Tons of screened GAS COAL for the Year ending June 1, 1906.

Tenders to be sent in on or before Monday, the 29th of May, 1905.

Particulars and Form of Tender may be obtained from the undersigned.

J. W. THOMPSON,
Gas and Water Manager.

Town Hall, Barnoldswick,
Yorkshire,

BOROUGH OF SMETHWICK.

GAS METERS.

THE Gas Committee are prepared to receive TENDERS for the supply of Wet and Dry ORDINARY METERS and Dry PREPAYMENT METERS, to be delivered at the Gas-Works, Smethwick.

Tenders, sealed and endorsed, to be delivered to the undersigned not later than Thursday, the 25th inst.

W. J. STURGES,
Secretary.

Gas Offices, Town Hall,
Smethwick, May 8, 1905.

BOROUGH OF SMETHWICK.

CANNEL.

THE Gas Committee invite Tenders for the supply of 1000 Tons of CANNEL of good class to be delivered as required during the Year ending June 30, 1906.

Tenders, sealed and endorsed, to be delivered to the undersigned not later than Thursday, the 25th inst.

W. J. STURGES,
Secretary.

Gas Offices, Town Hall,
Smethwick, May 8, 1905.

CITY OF HEREFORD.

THE Gas Management Committee of the Corporation invite TENDERS for the supply of best screened large GAS COAL for One Year, from the 1st of July next, to be delivered free at the Gas-Works Siding, Hereford, in such quantities as may be required from time to time.

The estimated quantity required will be about 13,000 Tons.

Full Particulars and printed Forms of Tender may be obtained on application to the undersigned.

Tenders, endorsed "Tender for Gas Coal," are to be sent in addressed to the Chairman, Gas Management Committee, Town Hall, Hereford, by Saturday, June 3, 1905.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
WILLIAM PARLBY,
Gas Engineer and Manager.

Gas-Works, Hereford,
May 11, 1905.

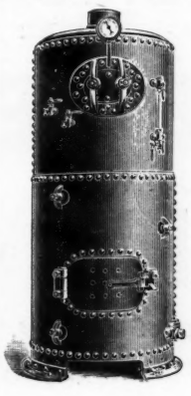
JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

THE
Grantham Crank & Iron Co., Ld.
GRANTHAM.



Makers of
STEAM BOILERS
(of all types and powers).

Vertical, Loco, Cornish, and Lancashire.

FEED-WATER HEATERS.
VERTICAL ENGINES.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. EDWARD PRICE, "Langley," Wyke Avenue, WORTHING.

RAILS.
New and Second-Hand with all Accessories; also Tip Waggons and Turntables.

B. M. RENTON,
MIDLAND WORKS,
SHEFFIELD.

THE
"ROTARY"
STATION METER.

Efficiency Demonstrated.

APPLY—
T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE, MANCHESTER.

Substantially well made for Inside and Outside Lighting.

PATENT RECUPERATIVE INTENSIFIED
INCANDESCENT GAS LAMPS
For INTERIOR LIGHTING.

The only Lamp with Burners
DUST AND INSECT PROOF.
ENGLISH MADE.
SUPERIOR FINISH.

A. E. PODMORE & CO.,
33, Charles St., Hatton Garden, E.C.

Telegrams: "PROMEROPE, LONDON."
Telephone No. 6600 Central.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE LIMITED,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

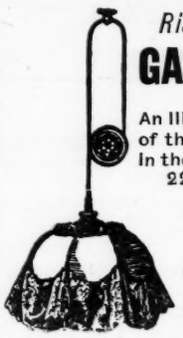
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.
LONDON OFFICE: R. CULL, 34, OLD BROAD STREET, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER,
Gas Engineers' Agents and Contractors for METERS, FIRE-CLAY GOODS, OXIDE OF IRON, AND ALL OTHER GAS APPARATUS.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

HEATHCOTE GAS COAL.
Rich in Illuminating Power and yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.
THE GRASSMOOR CO., LD.,
CHESTERFIELD.

THE "HANWELL" PATENT
Rising and Falling
GAS PENDANT.



An Illustrated Description of this Pendant appeared in the "Journal" for Nov. 22, 1904 (page 599).
Write for full Particulars to the
"HANWELL" Pendant Company,
96, ABINGTON STREET, NORTHAMPTON.

Gas Companies are solicited to try Samples of the
MIRFIELD GAS COAL
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.
Prices and Analysis on application.
The MIRFIELD (GAS-COAL) COLLIERIES CO.,
RAVENSTHORPE, NEAR DEWSBURY.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

Wrought-Iron
TUBES
And Fittings & Accessories.

LAMBERT BROS., WALSALL,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM.
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., LTD., 91 & 93, SOUTHWARK ST., S.E.

THE
GILBERT LITTLE CO'Y. LTD.
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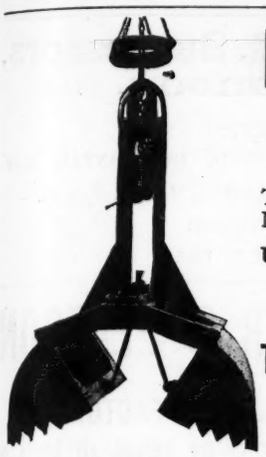

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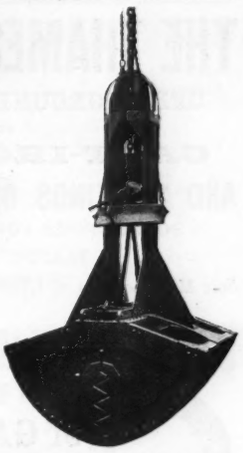

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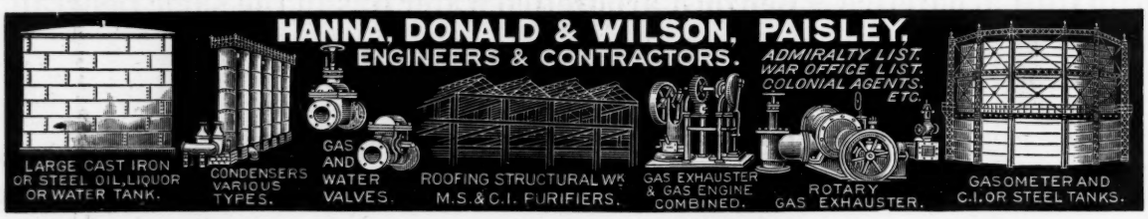
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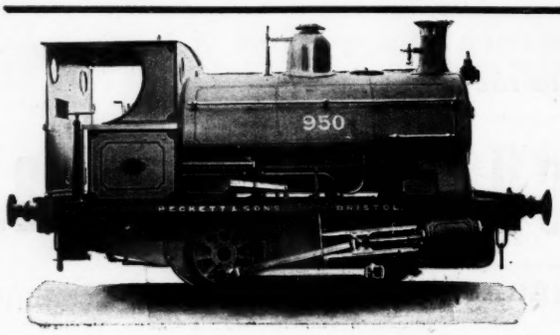

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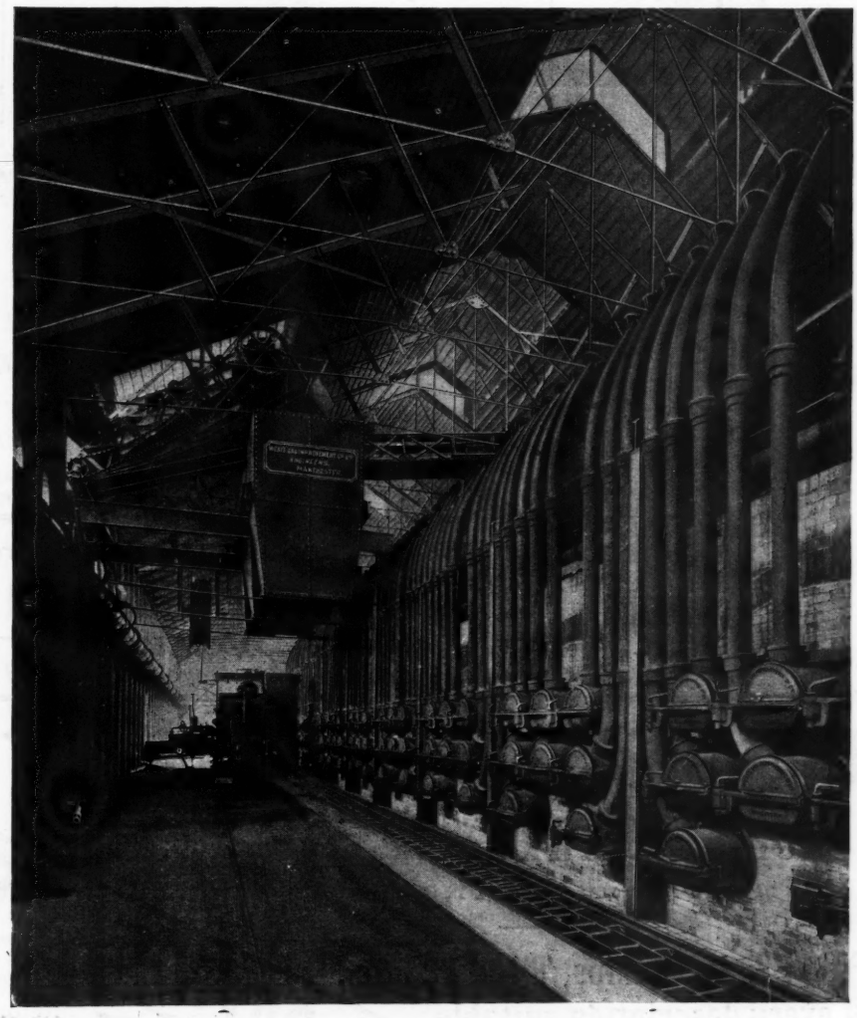

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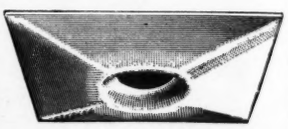

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Fig. 35. 100 c.p.

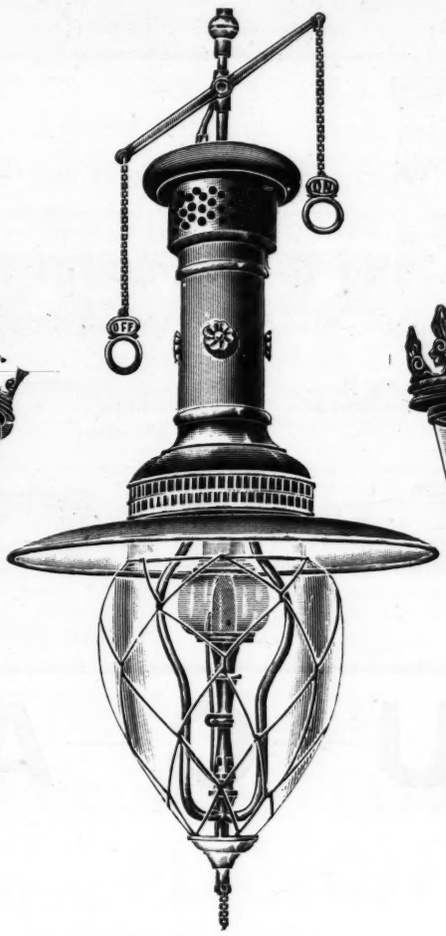

Fig. 607. 600 c.p.
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Fig. 35a. 300 c.p.
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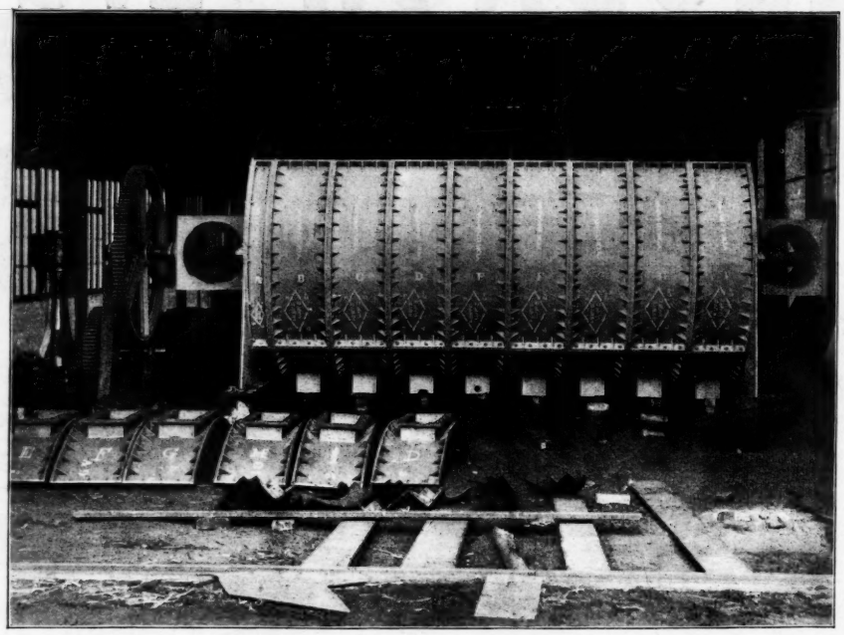

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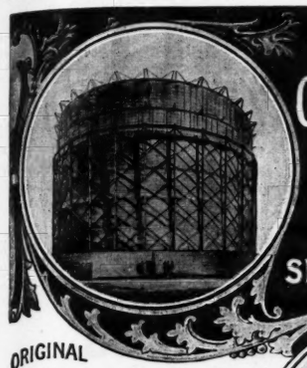

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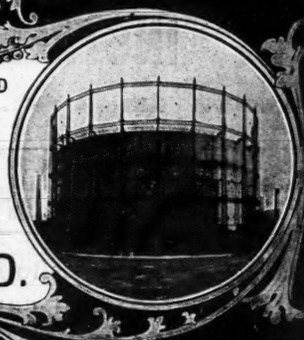

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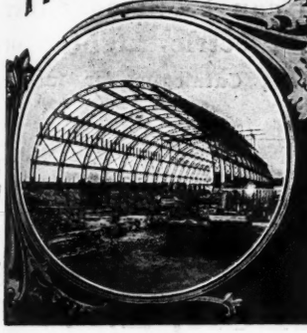

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